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IDENTIFIERS *Transition into Electronics Project

ABSTRACT

This dissemination package consists of a variety of advertising materials, forms, questionnaires, tests, and handouts developed as a part of the Transition into Electronics (TIE) Project. (The TIE Project was a project that developed, implemented, and evaluated a model designed to encourage persons to pursue education and training leading to nontraditional technical jobs in electronics.) Following a general discussion of the project, various advertising materials are provided, including a brochure, a newspaper article, and a radio announcement. Also included are a brief description of the project course, a typical course schedule, and a summary of the counseling component of the project. Preliminary and post tests are supplied along with preliminary, mid-course, and plant tour questionnaires. Also presented are a course completion and a followup postcard survey. Completing the package are assorted pass-out materials for the instructional components of the program. (MN)

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ED212754

DISSEMINATION PACKAGE

for

TRANSITION INTO ELECTRONICS (TIE) PROJECT

INSTITUTION: EVERGREEN VALLEY COLLEGE
San Jose Community College District
3095 Yerba Buena Road
San Jose, CA 95135-1598

DIRECTOR: ANDREW U. MCFARLIN, PROGRAM COORDINATOR
AND INSTRUCTOR IN ENGINEERING AND MECHANICAL
TECHNOLOGIES

PROJECT NO. 43-69658-2-0-017

TIME PERIOD: OCTOBER 1979 - JUNE 1980

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DISSEMINATION PACKAGE FOR
TRANSITION INTO ELECTRONICS

1. General Discussion & Comments
2. Advertising Materials
 - a. Brochure
 - b. Newspaper Article
 - c. Radio Announcement
3. Brief Description of Course
4. Typical Course Schedule
5. Counseling Component
6. Preliminary Questionnaire
7. Preliminary Test
8. Mid Course Questionnaire
9. Plant Tour Questionnaire
10. Student Referral Form
11. Post Test
12. Course Completion Survey
13. Follow Up Postcard Survey
14. Assorted Pass Out Material for Instructional Components

TRANSITION INTO ELECTRONICS (TIE)

General Discussion

Historically and in large part as a result of social conditioning and lack of exposure to technical education and employment, Displaced Homemakers and other special groups rarely seek technical jobs. Those who have obtained employment in electronics industries have tended to cluster in the traditional "women's areas" of secretarial, clerical, custodial, and assembly work positions which usually have the lowest salaries and most limited promotional opportunities.

The TRANSITION INTO ELECTRONICS (TIE) project developed, implemented, and evaluated a model instructional career counseling, and placement program. It was designed to encourage persons to pursue education and training leading to nontraditional technical jobs in electronics. The TIE program provided a supportive instructional and counseling environment responsive to the needs and concerns of the target program current homemakers employed part-time but seeking full-time employment and persons working in traditional jobs seeking employment in what are currently considered nontraditional jobs in the technical areas of electronics.

In a ten week, seven hours per week, team taught modularized program offered during two college semesters, a group of 32 TIE participants were instructed in the basic principles of electronics, electronic drafting, and electronic fabrication, and an introduction to basic computer functions and programming. Instructional methods included: lecture, small and large group instruction, demonstrations, hands-on laboratory experience, guest lectures by successful role

models in diverse technical positions in electronics, and visits to area electronics industries. Integral components of the program were individual and group career advising and counseling, aptitude and interest assessments, development of job-search skills, and work experience and job placement services. Participants were assisted in developing their interests in pursuing technical positions in electronics, identifying career directions, decreasing their anxiety concerning technically oriented subject matter and employment, and gaining the confidence necessary to pursue specialized experience or education necessary to move beyond entry level positions.

The TIE program recruited participants through a variety of approaches including: referrals from counselors and other campus programs, community based organizations and agencies (including women's groups); brochures, and public service announcements and advertisements. Program evaluation included pre and post testing of each participant, participant and staff evaluations of the program, a comprehensive evaluation by the college's institution by the college's institutional research personnel, and follow-up studies of participants.

Comments: Program Needs--Post Analysis

- 1--An organized process whereby participants completing the course can be involved in a follow up to determine the numbers:
 - a. Of those who go on to take technical courses to aid them in obtaining their objective in seeking a new technically oriented career.
 - b. Of those who go on to take courses leading to nontechnical career objectives.
 - c. Of those who go directly into technical employment.
 - d. Of those who go directly into nontechnical employment
 - e. Of those who make no immediate move or changes from their pre-course activity.
- 2--To provide an organized and planned means of obtaining part-time work in related technical fields for those whose financial obligations require immediate or on going income.
- 3--A Child care program to enable those persons with small children to obtain convenient and low cost child care.
- 4--A need to increase individualized counseling assistance during the the course.
- 5--A need to study the feasibility of presenting an early evening or evening program for the convenience of those who must have full-time day employment.

General Assessments.

It was the general consensus by all involved in this first time offered TIE course that all objectives were achieved. Of course, as with an "first time" course, various alterations and improvements

could be made. All groups involved with the TIE course: advisory committee, staff, participants were all given the opportunity to make known their comments and evaluation of the course and its achievement of the stated objectives. In-so-far as participant assessment of the course, one might be best directed to the synopsis of comments extracted from the final evaluation questionnaire under the section of Evaluation.

Participants, even those who had decided not to go on in a technical career, felt the experience had created knowledge, awareness, and recognition of capability. A general feeling was that much of the unknown feeling, apprehension, and mystique of things technical had been dispelled.

The use of industrially employed role models as instructors was established as a very important aspect of creating a realistic concept of what is involved in a particular technical career area in addition to the role image generated.

In a broad general sense, the effectiveness of the course might be measured by the fact that the Evergreen Valley College of the San Jose Community College District has seen fit to support this TIE course on an on going basis and is offering this course for the second time in the Fall of 1980. As the course continues to be offered, on going assessments will take place in order to develop the most student effective program.

The coordination and organization of the course continues to be a major element in the overall success. Much depends upon the availability of qualified instructors who can be drawn from local electronic industries during working hours. Further, the impaction of college facilities, caused by increasing gneral enrollments, creates problems for this type of special course that utilized a variety of instructional spaces on an irregular schedule.

ATTACHMENT 2a

Public transit is available to and from Evergreen Valley College every 30 minutes from 7 a.m. until 10 p.m.



Evergreen Valley College

3095 Yerba Buena Road
San Jose, California 95135
(408) 274-7900 ext. 350

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Capable of complete major layout and engineering drawings. V. exp. schematics. Work in the field. 246-8707

DRAFTING PERSON

Capable of complete major layout and engineering drawings. V. exp. schematics. Work in the field. 246-8707

DRAFTING PERSON

Capable of complete major layout and engineering drawings. V. exp. schematics. Work in the field. 246-8707

Your T.I.E. to the 1980s

Have you been trying to find a job that best suits you but find that everything is in electronics? You're right. According to the San Jose Mercury News, about half of their total of help-wanted ads, each day, are for technical jobs in the electronics industry.

Evergreen Valley College has a new and unique program designed to be of special interest to:

- Displaced Homemakers
- Single heads of families with few marketable skills
- Homemakers working part-time who need full-time jobs
- Persons in "dead-end" jobs seeking new and different careers

The purpose of the program is to introduce you to the variety of nontraditional careers available in the electronics field, and to a sampling of the basic concepts of electronics. You will then have an opportunity to choose follow-up education and training for specific jobs such as electronics drafter, test inspector, technician, or fabricator.

TRANSITION INTO ELECTRONICS (T.I.E.) is designed to help people such as yourself who may not have a science or math background. Enter

the program with an open mind about future education and training for technical jobs. Hopefully, this introduction will prepare you to make a better choice about the specific job that best suits you in the 1980's.

Program Description

T.I.E. will provide pre-admission advising and individual career counseling to help you identify your aptitudes for and interest in an electronics career. Follow-up support services will include help in developing job search skills, work experience, and job placement assistance.

Andrew McFarlin, Director of the program, has brought together a staff of highly competent instructors especially for the ten-week program.

One of the strong points of the program is the variety of instruction including guest speakers employed in electronics, visits to area electronics companies, lectures, small group instruction, demonstrations, and hands-on laboratory activities.

Place: Evergreen Valley College

Dates: Tuesdays and Thursdays,
February 19 to May 1, 1980

Time: 12:30 to 3:20 p.m. (with computer time in the laboratory by arrangement)

A Little Bit about Evergreen Valley College

Evergreen Valley College, a campus of the San Jose Community College District, is located in Santa Clara Valley, the worldwide center of the electronics industry.

The College is one of California's newest and most modern community colleges, having opened in 1975. It houses new and up-to-date instructional and laboratory facilities.

Call Us Today!

Provost: Educational Services

EVERGREEN VALLEY COLLEGE

3095 Yerba Buena Road

San Jose, California 95135

(408) 274-7900 ext. 350



San Jose Mercury News, Tuesday, January 22, 1980

West B 5

Opens electronics industry doors

Class to aid displaced homemakers

By Leland Joachim
Staff Writer

Four years ago, Evergreen Valley College developed a semester-long course to introduce people to technological fields and engineering. It was called Transition to Technology (TTT).

Recently instructor Andrew McFarlin has obtained a \$9,000 grant to start a program aimed at the "displaced homemaker," who wants to return to work.

"The idea is, in a brief period of time, to give persons who have never been employed or are seeking new employment a chance to sample a whole group of technical things," McFarlin said.

This program is called Transition into Electronics (TIE) and will start this semester along with TTT because the

grant from the California Vocational Education Program was received sooner than expected.

TIE will meet from 12:30 to 3:20 p.m. on Tuesdays and Thursdays, from Feb. 19 to May 1, at the college.

Participants will be exposed to electronic theory. The course will be tailored to students who have no previous experience with technology. They'll sample electronic fabrication, computers, career education and electronic drafting.

People from industry will be employed part-time as instructors and role models.

Tours will be taken to various work sites. "The idea of seeing the kind of facility they might be working in is an important aspect," said McFarlin.

"Another important factor are the fears and hesitations

and anxieties of people who have been out of school for a long time."

And there are home problems, some arising out of the prospect of the wife developing knowledge that may surpass her husband's.

The project has retained Counselor Pat Emard, in private practice as a marriage and family counselor, to work with the students. She was especially selected because of a sensitivity to such problems, McFarlin said.

The TIE class, a maximum of 30 students, will work together designing, assembling and testing a pocket transistor radio.

The course is "not really designed for a person to come out and go to work," but rather to give him a chance to see how he relates to electronics. The

expectation is that students will come back and take more courses and perhaps transfer to a four-year college.

Several former students possess degrees in "English or art or something they couldn't really develop any job skills out of," McFarlin said. The degrees were obtained as long as 30 years ago.

TTT has appealed to a wide range of students, from 19 or 20 years old into the 50s. Up to 75 percent have been women and minorities.

"We expect TIE to be similar," said McFarlin, adding that the course should appeal to many who never completed high school.

Some 75 percent of those who started TTT finished the semester. "I'm trying to shoot for a better record... this semester," McFarlin said.

ATTACIMENT 2c

Evergreen Valley College
3095 Yerba Buena Road
San Jose, CA 95135

Dr. Bernard Fradkin
274-7900 ext. 330

Spot Announcement

ANNOUNCER

OPEN NEW DOORS FOR YOUR FUTURE. HAVE YOU EVER WANTED TO EXPLORE A
NEW CAREER IN ELECTRONICS? WOULD YOU LIKE TO EXPLORE CAREER FIELDS
RELATED TO THE ELECTRONIC INDUSTRY? THROUGH THE TRANSITION INTO
ELECTRONICS SHORT COURSE NOW BEING OFFERED AT EVERGREEN VALLEY COLLEGE,
YOU CAN DO THIS. NO PRIOR TECHNICAL SKILLS OR KNOWLEDGE IS NECES-
SARY. THERE IS NO TUITION CHARGE. IF YOUR ARE INTERESTED, CALL
2-7-4-7-9-0-0 ext 286 NOW!!!

BRIEF DESCRIPTION OF COURSE

The TRANSITION INTO ELECTRONICS (TIE) program is designed to encourage persons to pursue education and training leading to nontraditional technical jobs in electronics. The TIE program will provide a supportive instructional and counseling environment responsive to the needs and concerns of the target program population: Displaced Homemakers, single heads of household lacking adequate job skills, current homemakers employed part-time but seeking full-time employment, and persons working in traditional jobs who seek employment in what are currently considered nontraditional jobs in the technical areas of electronics.

In a ten-week, seven-hours per week, team-taught modularized program, TIE participants will be instructed in the basic principles of electronics, electronic drafting, electronic fabrication, and introduction to basic computer functions and programming. Instructional methods will include lecture, small and large-group instruction, demonstrations, hands-on laboratory experience, guest lectures by successful role models in diverse technical positions in electronics, and visits to area electronics industries. Individual interest assessment, development of job-search skills, and work experience and job placement services will be integral components of the program. Participants will be assisted in developing basic technical understanding and skills, assessing the developing their interests in pursuing technical positions in electronics, identifying career directions, decreasing their anxieties concerning technically oriented subject matter and employment, and gaining the confidence necessary to pursue specialized experience or education necessary to

oriented subject matter and employment, and gaining the confidence necessary to pursue specialized experience or education necessary to move beyond entry level positions.

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AMM 11-29

COUNSELING COMPONENT
TRANSITION INTO ELECTRONICS
Fall Semester, 1980

SUMMARY:

In August and September I interviewed potential participants for the TIE Program in small groups. The purpose of these interviews was to explain the components of the program, ascertain the interest and suitability of students to the program, and determine their level of commitment. I interviewed a total of 35 individuals and accepted 31 to the program.

On the first day of class, 31 interviewed students plus an additional 12 non-interviewed students showed up. Once again the program was explained, books handed out, and initial paperwork completed---registration, pre-course test, survey, etc.

The counseling component of the TIE program mainly consisted of three meetings (6 hours) that focused on an overview of career planning.

Session 1: The World of Work

Discussion about what is work, why people work, the importance of determining your own interests, needs, goals, values, lifestyle preferences prior and as part of making career choices.

Session 2: Know Thyself

Discussion and experiential exercises dealing with self-assessment. Used material gleaned from Richard Bolles that assisted students to ascertain their individual strengths and weaknesses, skills and abilities and looked at areas of their lives in which they were getting their needs met. Discussed the importance of balancing personal and work lives.

Session 3: Future of Work

Discussed the work world in the year 2000 and the ways in which the demand for skilled workers will increase. Looked at some of the ways the electronic industry will impact on our daily lives and the extent to which the technical skills of electronic workers will be utilized in heretofore undetermined careers.

Also did a brief overview of interviewing techniques for those students who plan to look for work on either a part or full-time basis.

A breakdown of the student participants is attached as well as an overview of the background of those initially interviewed.

NUMBER INTERVIEWED:

<u>INTERVIEWED</u>	<u>SHOWED UP ON FIRST DAY</u>	<u>DROPPED OUT</u>	<u>COMPLETED COURSE</u>
35	31	12	19
<u>NOT INTERVIEWED</u>	<u>SHOWED UP ON FIRST DAY</u>	<u>DROPPED OUT</u>	<u>COMPLETED COURSE</u>
12	12	7	5

TOTAL COMPLETIONS: 24

ETHNIC BREAKDOWN

INTERVIEWED:

	<u>Men who completed</u>	<u>Men who dropped</u>	<u>Women who completed</u>	<u>Women who dropped</u>
Anglo	0	2	6	2
Black	4	0	0	1
Hispanic	2	3	4	4
Asian	1	0	0	0
Other	<u>0</u>	<u>0</u>	<u>2</u>	<u>0</u>
	7	5	12	7
<u>NOT INTERVIEWED:</u>				
Anglo	0	2	1	1
Black	0	0	0	0
Hispanic	2	0	0	1
Asian	1	3	1	0
Other	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>
	3	5	2	2

Summary of pre-TIE interview questionnaires:

1. Most interviewees learned about TIE from the college schedule of classes and the newspaper.
2. While the number of married/separated interviewees only slightly outnumbered the single interviewees, the number of married/separated students who completed TIE was double the number of singles. Likewise, the number of students who completed who had children far exceeded the number who had no children.
3. Approximately 50% of the interviewees worked at time of interview. Of those who dropped out, most were unemployed. This might indicate that individuals with prior work experience were more interested in TIE.
4. Of those who completed, over 60% had family incomes of over \$12,000 per year, and it appears that most were being supported by someone else. Of those who dropped out, a few were self-supporting, but most were single and living with parents.
5. Approximately 50% of interviewees indicated that they were primarily interested in technical skills. The remainder were either uncertain or interested in professional/managerial skills.
6. The educational goals of completers were varied, but most indicated that they intended to attain specific job training or additional education. Those who dropped out had rather unclear educational goals.
7. Of the completers, over one-half had at least 12th grade education and another one-third had completed college, some with Masters' degrees. Of those who dropped out, only 2 had had any prior college education and most were recent high school graduates.
8. Of the completers, the major obstacles anticipated was the possibility of being unable to meet demands of home/work and school and some concern about child care. Among those who dropped out, the possibility of financial problems was indicated. This seem to come from those single students who were supporting themselves and had no real educational plan worked out.
9. Both the completers and those who dropped expressed an interest in gaining a hands on experience mainly. It seemed that while they were interested in the information and exposure, it was the hands on facet of TIE that attracted them.
10. Most interviewees were likewise interested in learning more about the field of electronics before committing themselves to specific electronic classes. While they knew TIE would not lead to jobs, they were particularly interested in learning about the job openings salaries, opportunities for advancement, and possibilities in various companies for those with technical backgrounds. While they were interested in information and exposure to career planning in general, their main focus seemed to be to cut down the time it might take to choose a "new career" by determining in 10 weeks whether or not they would be suitable to the field of electronics.

RECOMMENDATIONS:

1. Include as part of the curriculum a speaker or panel of speakers from each aspect of the field of electronics covered in TIE (ie, drafting, computer programming, electronic tech) to answer questions related to his/her field and to discuss opportunities, training needed, etc.
2. Require each student to take a battery of career interest tests as an adjunct to the career planning/personal skills component of TIE.

This may encourage students to do some serious career planning in addition to the exposure I provide in the counseling component.

3. Perhaps we could include a mid-program evaluation next time to ascertain those elements of TIE that are the most useful to participants. This might assist to modify the remaining weeks' program to the best advantage.

I found that teaching the counseling component to a mixture of regular students and reentry students and a mixture of men and women to be quite different from the "displaced homemakers" of the prior semester. My sense is that the TIE program is best suited to the adults who have had some life experience, either in the work force or in the home, that causes them to be more committed to such an intense, hands-on experience. I feel that when possible, the reentry student should be given preference to TIE.

Transition Into Electronics

Getting Acquainted

1. Of all you've heard about the Transition Into Electronics course, what interests you most? _____
Why? _____
What interests you least? _____
Why? _____
2. Describe your feeling right now about enrolling in Transition Into Electronics.
____ very confident
____ confident
____ neutral
____ anxious
____ scared
____ interested
____ other _____ (please specify)
3. Are any members of your family or close friends employed in a technical field?
____ yes ____ no
4. Have you ever worked in a technical type of job? ____ yes ____ no
If "yes", briefly describe your work _____
5. How much do you know about electronics occupations?
____ nothing
____ very little
____ a fair amount
____ a great deal
6. Do you feel you must be good in mathematics and science to enter an electronics field? ____ yes ____ no
7. Are you currently enrolled, in addition to Evergreen, in:
____ high school
____ adult school
____ trade school
____ 2 year college
____ 4 year college
____ not enrolled in another school

8. How many units are you enrolled in this semester? (TIE is a 3-unit course.)

_____ units

9. What did you think about your last experience in school?

_____ excellent
_____ good
_____ average
_____ poor
_____ very poor

10. Diploma/certificate received:

_____ 8th grade
_____ high school
_____ GED
_____ baccalaureate
_____ other
_____ none

11. Language

_____ bilingual (English plus another language)
_____ English only
_____ Spanish only
_____ only (please specify)

12. Veteran? _____ yes _____ no

13. Head of household? _____ yes _____ no

14. Sex _____ female _____ male

15. Ethnic background

_____ Afro American - Black
_____ American Indian
_____ Asian American
_____ Filipino American
_____ Foreign
_____ Mexican American - Chicano - Latino
_____ Caucasian
_____ Other

16. Age group

_____ 16-19
_____ 20-29
_____ 30-39
_____ 40-49
_____ 50-59
_____ 60-69
_____ 70-79
_____ other _____ (please specify)

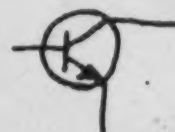
Transition Into Electronics Preliminary Test

The following are some questions to help our staff to better address your individual needs. You are not expected to necessarily know the correct answers. Give them a try. Good luck.

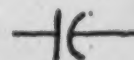
1. A flashlight operates on AC _____ DC _____ current.
2. An electrical circuit is usually made up of four parts or components. These are:

a. _____ b. _____
c. _____ d. _____

3. Name the following symbol:



- 4 Name the following symbol:



5. The length of a wire conductor does not affect its current carrying capacity. True _____ False _____

6. What is the dimension indicated on the scale below?

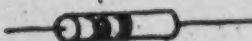
- a. $3/4"$
b. $11/16"$
c. $23/32"$
d. $47/64"$
e. $25/32"$



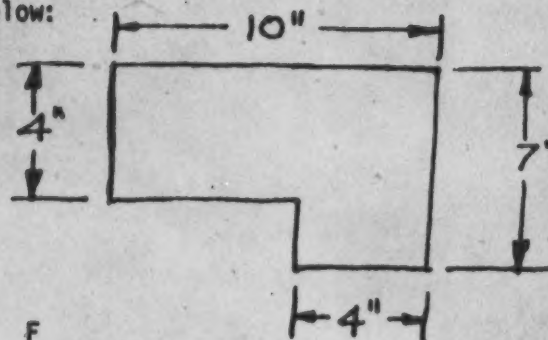
7. The decimal equivalent of $3/4"$ is:

- a. .333" d. .120"
b. .133" e. .750"
c. 1.33"

8. Identify the following:

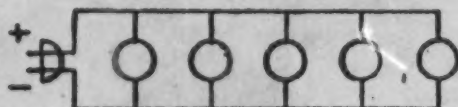


9. What is the area of the sheet metal part below:

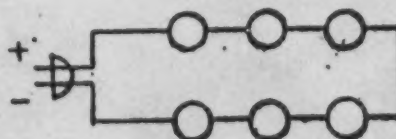


10. Fortran is a computer language. T _____ F _____
11. All computer information must be stored as a series of positive or negative signals. T _____ F _____
12. There are two types of Christmas tree light wiring systems. In one, if one light goes out, they all go out. In the other if one light goes out the remainder remain lit. In which system below would the latter situation exist?

a. _____ b. _____

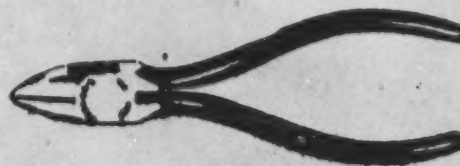


a

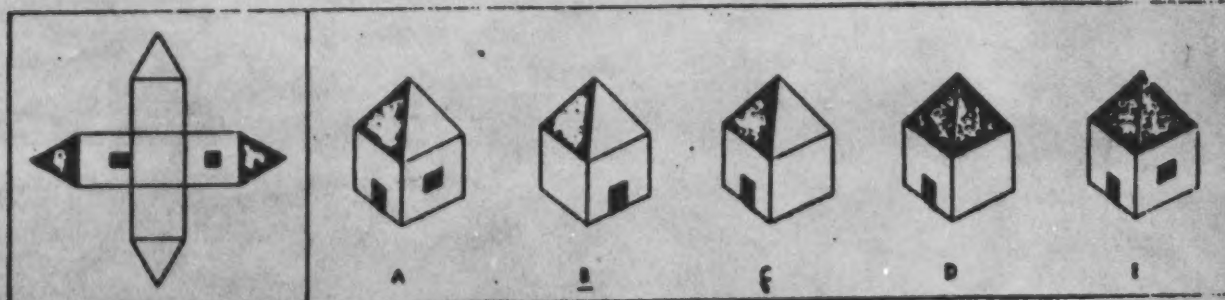


b

13. Identify as completely as possible the following tool:

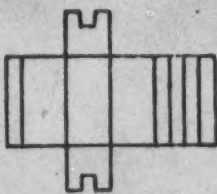


14. Resistors values are identified by color bands or stripes. T _____ F _____
15. An electrical coil when energized creates a magnetic field. T _____ F _____
16. If you fold the figure to the left, which figures to the right could be formed? There may be more than one correct answer. Circle all which are correct.



ATTACHMENT 7

17.



A

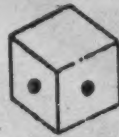
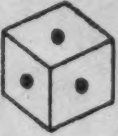
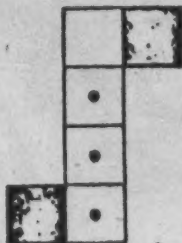
B

C

D

E

18.



A

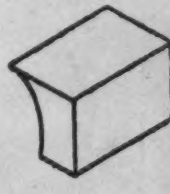
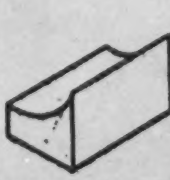
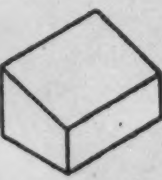
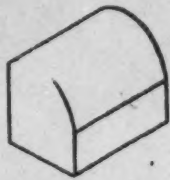
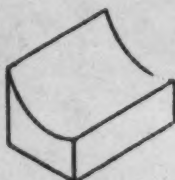
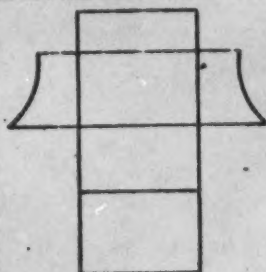
B

C

D

E

19.



A

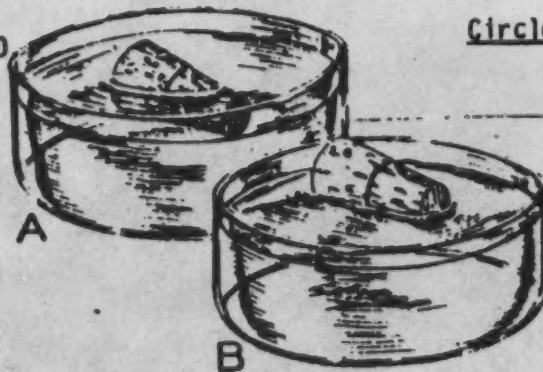
B

C

D

E

20.



Circle the correct answer

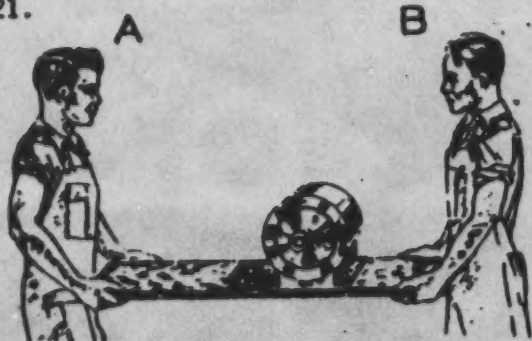
Which liquid is heavier?
(If equal, mark C.)

A

B

C

21.



Which man has the
heavier load?
(If equal, mark C.)

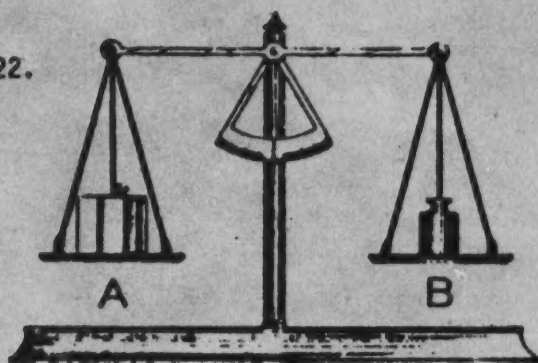
A

B

C

Circle the Correct Answer

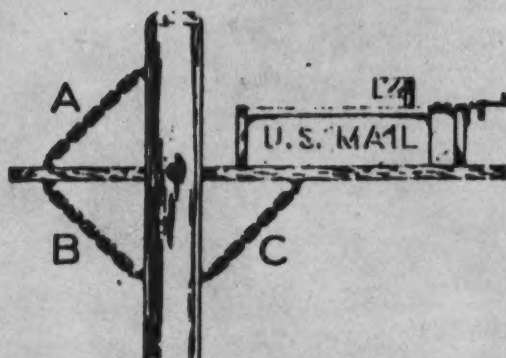
22.



Which weighs more?
(If equal, mark C.)

A B C

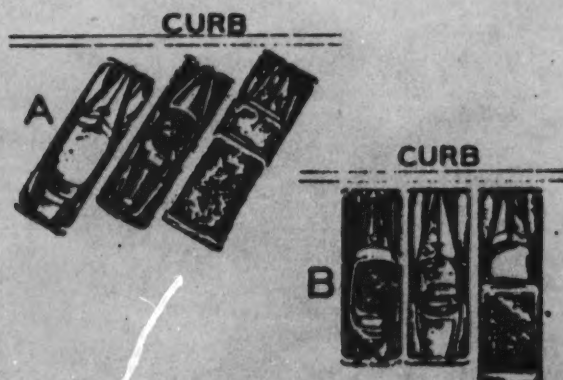
23.



Which one piece of chain
is needed to support the
mail box?

A B C

24.



Which way can more cars
be parked in a block?
(If equal, mark C.)

A B C

Spring 1980

Name _____

MID-COURSE SURVEY
Transition to Electronics Program
How Are We Doing So Far?

Please be as brief or as lengthy as suits you.

I like studying a variety of subjects in one course. Yes _____ No _____

Why? _____

I like having several instructors in one course. Yes _____ No _____

Why? _____

The TIE Program is living up to my expectation. Yes _____ No _____

Why? _____

What do you like about the TIE Program? _____

What do you dislike about the TIE Program? _____

Space for comments about the TIE Program _____

I feel I'm becoming acquainted with the electronics field. Yes _____ No _____

Why? _____

FIELD TRIP QUESTIONNAIRE

FOR STUDENTS

Name (Optional) _____

Location of field trip _____

Please answer the following questions. Your response will help us determine the value of this trip. Thanks.

1. The field trip gave me a chance to learn things that have not been covered in class or labs.

Yes _____ No _____

2. The field trip was given at a good time during the semester.

Yes _____ No _____

If no, why not? _____

3. The people we met during the field trip were--

interesting	Yes _____	No _____
informed	Yes _____	No _____
helpful	Yes _____	No _____
understandable	Yes _____	No _____

4. I could hear what was being said during the field trip.

Yes _____ No _____ Some of the time _____

5. I could see what was being demonstrated during the field trip.

Yes _____ No _____ Some of the time _____

6. The field trip helped me make decisions relating to my job choice.

Yes _____ No _____ Some of the time _____

7. The field trip was a good length of time.

Yes _____ No _____ Some of the time _____

8. I understood what was presented during the field trip.

Yes _____ No _____ Some of the time _____

9. I recommend that this field trip be offered to future classes.

Yes _____

No _____

Some of the time _____

10. OPTIONAL: I would like to add these comments about the field trip.

RETURN TO INSTRUCTOR

EVERGREEN VALLEY COLLEGE

Student Referral

Student _____
LAST FIRST

Referred to _____

For _____

Referred by _____ Date _____

Class or Activity _____

Student interview by _____ Date _____

Action taken _____

Recommended follow-up _____

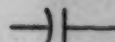
TRANSITION INTO ELECTRONICS

POST COURSE TEST

1. This is the electrical symbol for a _____
 (a) Capacitor; (b) Coil; (c) Resistor; (d) Ground; (e) Battery



2. This is the electrical symbol for a _____



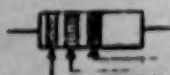
3. This is the electrical symbol for a _____



4. The value of a resistor is measured in _____
 (a) Hertz; (b) Amps; (c) Ohms; (d) Watts; (e) Volts

5. Electrons flow from a negative to a positive until there is no potential difference. This movement is termed _____
 (a) Voltage; (b) Current; (c) Ohms; (d) Hertz (e) Magnetic Induction

6. The value of the resistor shown would be _____
 (a) 1,000 Ω (b) 2,000 Ω (c) 20,000 Ω (d) 2,000,000 Ω (e) 1,000,000 Ω

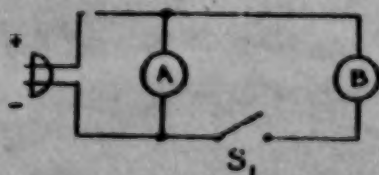


GREEN BLACK RED

7. Voltage is a product of current flow and resistance and can be found through Ohm's Law
 (a) $P=E \times I$; (b) $A=I^2R$; (c) $I=RA$; (d) $C=TTD$; (e) $E=I \times R$
8. If a wire of x diameter is 8 feet long and has 1 ohm of resistance, then a wire of the same x diameter and 16 feet long would have _____ ohms resistance.
 (a) 2; (b) 0.5; (c) 128; (d) 24; (e) 8
9. Draw the symbol for a transistor and label its three parts.

10. The lights on an automobile operate on AC ___ DC ___ current.

11. If we close switch S_1 will light B go on ? yes ___ no ___

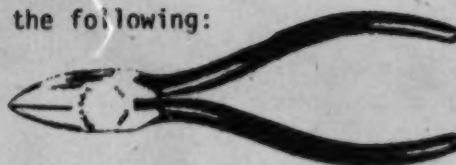


12. Name three types of drawings associated with IC drawings.

13. Identify as completely as possible each of the following:



a. _____



b. _____



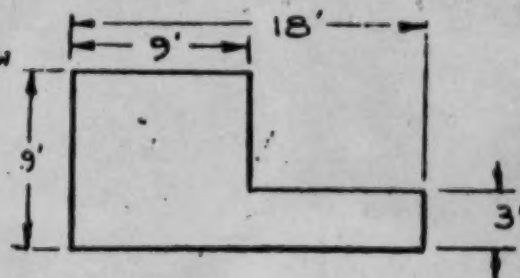
c. _____



d. _____

14. What is the area of the figure below

- a. 162 sq. ft.
- b. 108 sq. ft.
- c. 135 sq. ft.
- d. 54 sq. ft.
- e. 189 sq. ft.



15. To tighten a normal bolt it would be rotated counterclockwise. T F

16. Computer flow charts are used to

- a. input specific data to a computer
- b. measure computer output
- c. show basic or general steps or segments of a total computer program
- d. debug a faulty computer program
- e. indicate storage areas in a computer program

17. What is the dimension indicated on the scale below?



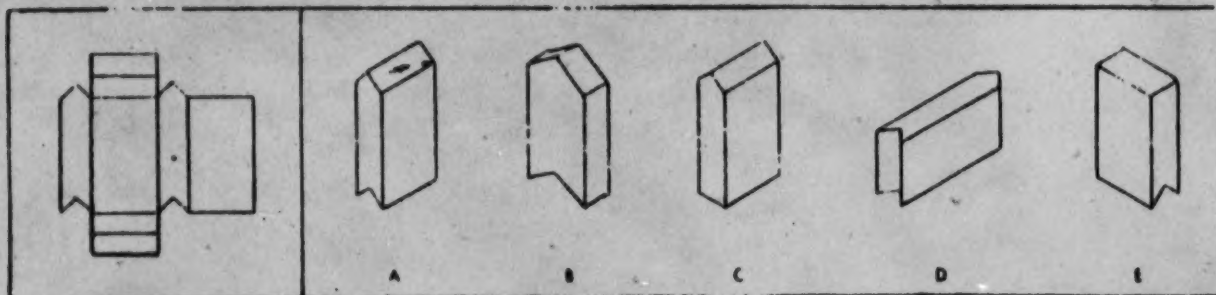
- a. 9/16
- b. 17/32
- c. 5/8
- d. 25/64
- e. 37/64

18. What is the decimal equivalent of $3/8$?

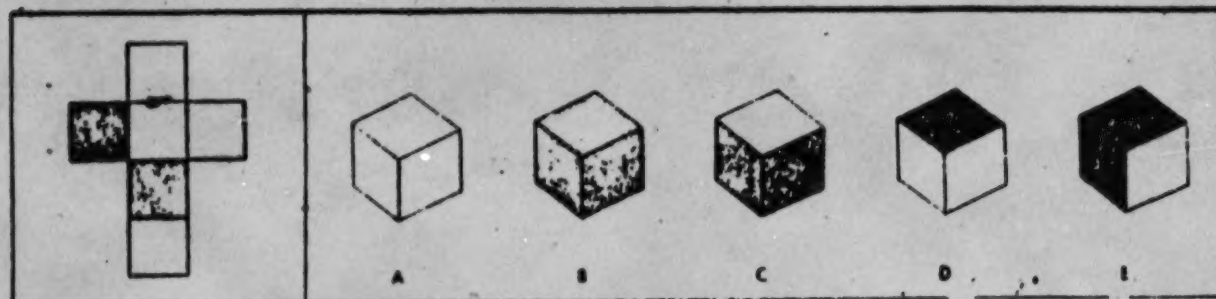
- a. .750"
- b. .500"
- c. .375"
- d. .375"
- e. .250"

Below there are some figures. If you fold the figure to the left, which figures to the right could be formed? There may be more than one correct answer. Circle all which are correct.

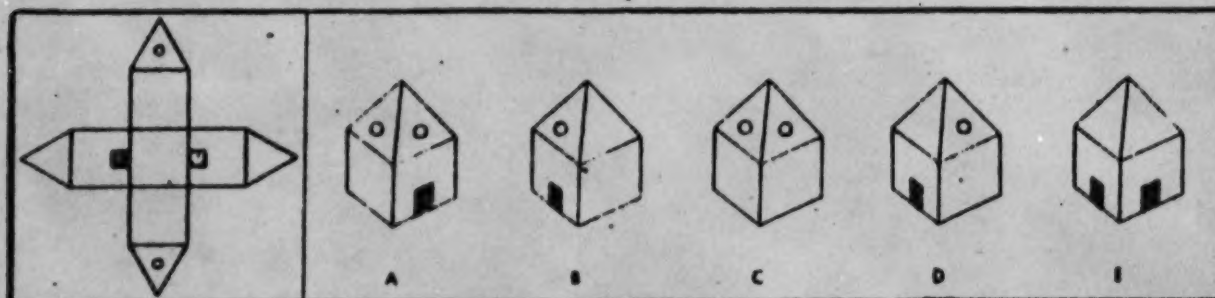
19.



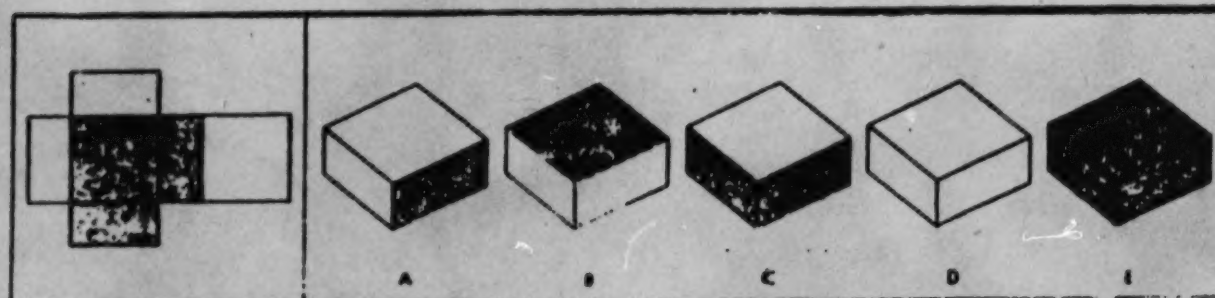
20.



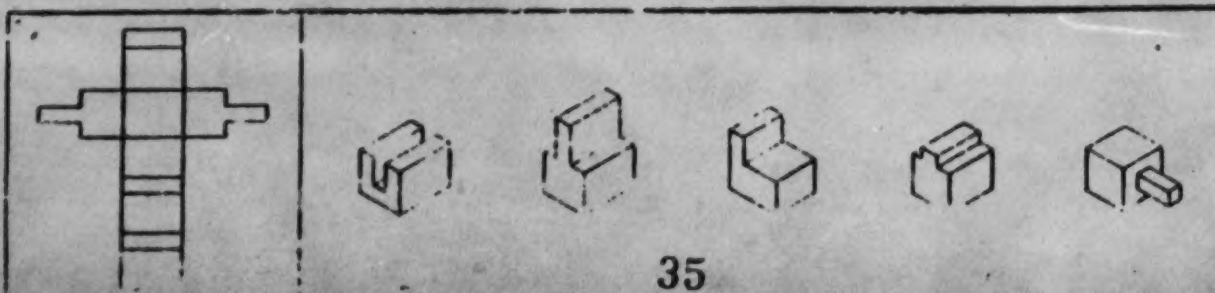
21.



22.



24.



Name _____

Transition Into Electronics

Course Completion Survey

Congratulations! We'd like to keep in touch, so if you'd fill in your address and phone number, we'd appreciate it.

Also, we'd appreciate your opinions. Use the backs of these sheets and additional pages if you need more room for your comments.

Did TIE meet your needs? ☐ Yes ☐ No ☐ Partly

As a result of being enrolled in the TIE program, what are your plans for next semester?

- ☐ take more courses in an electronics education program
- ☐ take more courses in electronics drafting
- ☐ take more courses in some aspect of computer work
- ☐ take more courses in some other type of technically oriented activity
- ☐ continue college, in area(s) which is (are) not technically oriented activity
- ☐ obtain a job, but not in an electronics field
- ☐ obtain a position in an "on the job training program"
- ☐ undecided
- ☐ other (please state) _____

Please rate the following according to your TIE experience.

	EXCELLENT	FAIR	POOR	DON'T KNOW	COMMENTS
time of classes	_____	_____	_____	_____	please use back of page
location of classes	_____	_____	_____	_____	
quality of teaching	_____	_____	_____	_____	
laboratory work	_____	_____	_____	_____	
field trips	_____	_____	_____	_____	
counseling	_____	_____	_____	_____	
organization of course	_____	_____	_____	_____	
outside speakers	_____	_____	_____	_____	
electronics drafting	_____	_____	_____	_____	
electronics theory	_____	_____	_____	_____	
fabrication and assembly	_____	_____	_____	_____	
computers	_____	_____	_____	_____	

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TIE Course Completion Survey

Please indicate whether you agree or disagree with the following sentences by placing the letter designation for the phrase which most closely matches your feeling in the space preceding each sentence.

(a = highly agree) (b = agree) (c = disagree) (d = highly disagree)
(e = don't know)

- ☐ I have gained a greater understanding of electronics ideas
☐ I have gained a greater understanding of electronics skills
☐ I have gained information about the job opportunities in electronics fields
☐ TIE has helped me to decide on a career or vocational goal
☐ I feel more positive about a career in an electronics field
☐ I feel there are career opportunities available for women in electronics fields
☐ TIE gave me a broader view of career choices

Was the course material presented in a way you could understand and relate to?

☐ Yes ☐ No ☐ sometimes

Were instructors concerned with your individual needs?

☐ Yes ☐ No ☐ sometimes

What did you like best about the TIE Program? _____

What did you like least about the TIE Program? _____

In which instructional area would you have liked to spend more time?

Why? _____

What do you wish had been included? _____

TIE Course Completion Survey

Which section of the TIE Program (electronics drafting, electronics theory, fabrication and assembly, computers) was:

the most difficult?

the easiest?

the most enjoyable?

the most useful to you?

the least useful to you?

Have you decided on a definite career or vocational choice?

yes, a career in

sort of, maybe

no

We have enjoyed your participation in this program and we would appreciate any other comments you might have.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

DEAR FRIEND,

DURING THE SPRING SEMESTER OF 1980, YOU WERE ENROLLED IN OUR CLASS, TRANSITION INTO ELECTRONICS. WE ARE INTERESTED IN OBTAINING YOUR RESPONSE TO THE FEW QUESTIONS ON THE ATTACHED CARD. WOULD YOU PLEASE TAKE A COUPLE OF SECONDS TO CHECK OFF THE APPROPRIATE RESPONSES AND DROP THE CARD IN THE MAIL.

THANKS,

1. ARE YOU CURRENTLY EMPLOYED? NO ☐/ YES ☐/

IN A TECHNICAL FIELD ☐/ IN A NONTECHNICAL FIELD ☐/

NAME OF EMPLOYER _____

2. ARE YOU CURRENTLY TAKING ANY TECHNICALLY ORIENTED COURSES OR TRAINING PROGRAMS IN A SCHOOL OR OTHER ORGANIZATION?

NO ☐/ YES ☐/

IF YES, PLEASE LIST COURSES OR PROGRAMS:

3. DO YOU FEEL YOUR EXPERIENCE WITH THE TRANSITION INTO ELECTRONICS PROGRAM HAS HAD ANY INFLUENCE ON YOUR WORK OR EDUCATIONAL DECISIONS?

YES ☐/ SOME ☐/ NO ☐/

4. DO YOU FEEL THIS PROGRAM WOULD BE BENEFICIAL TO OTHERS?

YES ☐/ NO ☐/



Name: _____

Date: _____

Period: _____

TECHNICAL GLOSSARY

- ACCIDENT:** An unplanned or unexpected occurrence usually resulting in injury. Most common shop accidents can be prevented by observing safety rules, working carefully, and using common sense.
- ARTIFICIAL RESPIRATION:** A life saving procedure used to revive a person who has stopped breathing. Artificial respiration may be required as a result of electric shock, drowning, strangling, etc.
- CARDIAC ARREST:** A loss of heartbeat caused by electrical shock, or high blood pressure. Closed cardiac massage is the recommended first aid procedure.
- ELECTRIC SHOCK:** The flow of an electric current through the body. Shock can cause such physical effect as muscle twitching or paralysis, burns, interruption of breathing, unconsciousness, ventricular fibrillation, cardiac arrest, or death.
- FIRE:** A combustion process characterized by heat, flame, and light. There are three general classes of fire: Class A fires involve wood, paper, rubbish, and fabrics; Class B fires involve oil, grease, gasoline, paints, and solvents; Class C fires involve insulation and other combustible materials in electrical and electronic equipment.
- FIRE EXTINGUISHER:** A portable, selfcontained device holding a liquid, or chemical which can be sprayed on a fire to extinguish it.
- FIRST AID:** Emergency treatment for injury, accidents, or sudden illness generally administered before regular medical care is available.
- FLAMMABLE:** A designation for types of materials which are easily ignited or set on fire. Other designations may be used to identify these materials, such as; combustible or inflammable.
- GROUNDING:** A safety precaution which calls for placing the metal housing or case of a device at ground potential to prevent possible operator shock. Most commonly, a third wire is added to the power cord. This wire is connected between the case and earth ground allowing an alternate path for current flow. Thus, if the metal housing of a device becomes electrically "hot", current will flow through the grounding wire to the earth, instead of through the operators body to earth.

HAND TOOLS: This term refers to a wide variety of tools which require physical manipulation or primarily the use of your arms and hand muscles for their operation and use. Examples of typical hand tools would be; screwdrivers, wrenches, soldering irons, pliers, etc..

HAZARD: The presence of a dangerous or potentially dangerous situation.

HORSEPLAY: The undesired, potentially hazardous activity of clowning, or playing in the shop or laboratory.

INJURY: Physical harm or damage to ones body.

LIVE CIRCUIT: An electrical circuit which is energized, (power applied switch on) and capable of producing current flow.

MACHINE TOOLS: Generally, power assisted tools utilized for "heavy" jobs which require work beyond that supplied by hand tools. Examples of machine tools; drill press, grinders, sheet metal shears, box and pan break, etc..

SAFETY GLASSES: Protective eye glass with shatter proof lens and side shields. Safety glasses should be worn at all times when necessary while working in the shop. They provide invaluable protection by preventing foreign materials (pieces of wire, chips, broken glass, chemicals etc.) from entering or coming in contact with the eyes. Goggles and face shields can be utilized to provide additional eye protection while working in extremely hazardous areas.

SAFETY PRECAUTION: An action taken, followed or observed to avoid a possible hazard or dangerous situation.

SAFETY RULES: A specific list of rules designed to identify common accident causing situations and hazards. By observing the safety rules many accidents will be avoided or prevented.

SAFETY ZONE: An identified area around a piece of equipment within which only the operator or instructor should stand. For safety, all other individuals are to remain outside of the safety zone.

VENTRICULAR FIBRILLATION: A type of heart failure, caused by electric shock, in which the heart muscle no longer beats in a regular fashion but rather quivers erratically. If this condition is not corrected rapidly, death will result.



Name: _____

Date: _____

Period: _____

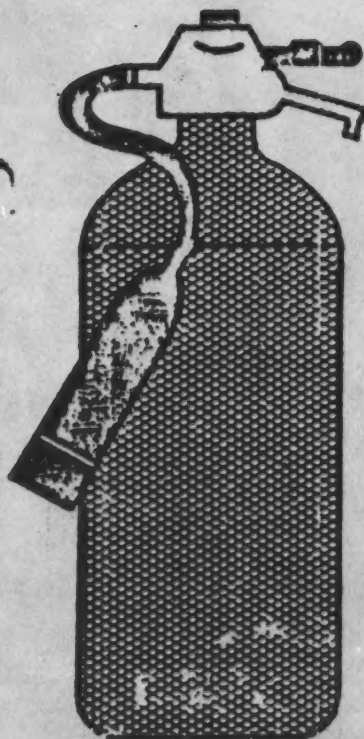
INFORMATIONAL HANDOUT

CLASSIFICATION OF FIRES AND EXTINGUISHING TECHNIQUES

There are three classification categories for fire. Each type of fire requires special extinguishing techniques. Use the chart below to distinguish the extinguishing techniques.

Class "A"

Fires involving combustible material such as wood, paper or cloth: to extinguish, cool and quench with pump type extinguishers containing water, or soda-acid. CO₂ (carbon dioxide) extinguishers may also be used.



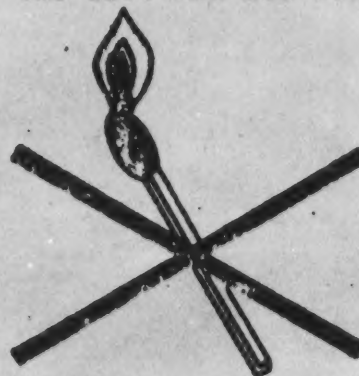
Class "B"

Fires involving flammable liquids such as gasoline, kerosene, greases, thinners, and finishes: smother the burning fuel. Foam and CO₂ type extinguishers may be used.

Class "C"

Fires involving electrical equipment: use a nonconducting type extinguisher such as CO₂ or dry powder, and if possible disconnect the source of electrical energy.

NOTE: Always point the fire extinguisher nozzle at the source of the fire and not at the top of the flame.



Name: _____

Date: _____

Period: _____

GENERAL SAFETY RULES:



Shop Behavior and Safety Practices

1. Clowning, scuffling, pushing, running, and throwing objects are dangerous practices in any shop and are forbidden at all times.
2. Obey all warning signs--they are posted for your protection.
3. Caution any student you see violating a safety rule.
4. When using machines or hand tools, give the job at hand all of your attention.
5. Work at a speed consistent with safety. "Foolish hurry," such as rushing to complete a procedure, is dangerous.
6. Cooperate with your classmates in the shop cleanup program.
7. Machines must not be operated while instructor is out of the room.
8. If equipment is not working properly, shut it off and tell the instructor at once.
9. Report to the teacher all breakage or damage to tools, machinery, or equipment.
10. A student who sees a dangerous situation must report it at once to the teacher.



Eye Protection

11. Eye protection must be worn when working in an area where hazardous conditions exist.
12. Face shields or goggles shall be utilized where extra protection is required, such as while grinding or working with caustic substances.
13. Eye glasses must not be used in place of goggles or face shields.
14. When compressed air is used for cleaning, wear eye protection. Take care to direct chips, shavings, and dust away from other students.
NEVER ALLOW THE STREAM OF AIR TO COME IN CONTACT WITH YOUR BODY.

Date: _____

Period: _____



Clothing

15. Wear safe clothing when working in a shop. Fasten or remove loose clothing before you operate any machine. Roll long sleeves above the elbows. Apron fastening should be such that they will break if the apron becomes entangled in a machine.
16. Long, loose locks of hair can easily be caught in revolving machinery and ripped out causing serious scalp laceration. Have your hair cut short, tied back, or tightly covered.
17. Wearing gloves is forbidden when you are working with power driven machinery in the lab.
18. Remove jewelry--bracelets, rings, chains, and other accessories that are hazardous in shop work.
19. Sharp, pointed tools or materials are not to be carried in clothing. Hold sharp points and sharp edges down.
20. Always wear protective clothing when working with chemicals. Rubber gloves should be worn when handling chemicals or immersing your hands in chemical solutions.
21. Always wash hands with soap and water after working with materials that might be harmful to the skin.



Housekeeping

22. Keep your work area clean and orderly. Good housekeeping is part of safety.
23. Keep floors, aisles, and passageways clear of materials and equipment.
24. Keep tools in a safe place. Never leave them where they may cause injury. Put them in tool boxes, trays, cases, or on wall panels.
25. Store material neatly and securely and in a place where persons passing will not be injured.
26. If water, grease or oil is spilled on the floor, clean it up immediately to prevent slipping.
27. Extension cords shall always lie flat on the floor in such a way that students will not trip over them.
28. Always use a brush to clean off benches and machines. There may be sharp or jagged particles among the scraps, which could cause serious injury to the hands.

Date: _____

Period: _____



Clothing

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28. Always use a brush to clean off benches and machines. There may be sharp or jagged particles among the scraps, which could cause serious injury to the hands.

Date: _____

Period: _____

29. Always keep bench, cabinet drawers, and locker doors closed.
30. Keep tools and materials from projecting over the edge of benches or tables whenever possible.



Approval

32. Students are warned not to use machines until they have been given the proper safety instruction, and received permission from the teacher. The student must ask for further instructions if in doubt concerning any operation.
32. When in doubt, ask the instructor. Do not depend upon the advice of another student.
33. The shop safety test must be passed by students in order to operate any power driven machines.
34. Do not operate switches of machines and instruments unless given permission to use them by the instructor.
35. Ask your instructor to approve all projects you plan to do.
36. Repairs are to be made on shop equipment only when permission has been given. Do not tamper with shop equipment.
37. All special set-ups in the lab. must be approved before the power is turned on.



Injury

38. Report all accidents, however slight, to the instructor at once. Infection may result from uncared for cuts and scratches.
39. When lifting heavy objects, keep your arms and back as straight as possible, bend your knees, then lift with the powerful muscles in your legs.
40. Do not attempt to lift heavy items alone. If there is any doubt in your mind about your ability to safely lift an object, ask for help.
41. Screws, nuts, and other nondigestible materials are never to be placed in one's mouth.



Date: _____

Period: _____



Fire

42. The location of fire extinguishers, fire exits, and fire drill procedures shall be known by all students.
43. Nothing shall be hung on fire extinguishers. The area around them must be kept clear so that they may be reached without delay if a fire were to occur.
44. When pouring flammable liquids, be careful not to spill them.
45. Oily or paint-filled rags must be placed in a covered metal container.
46. Toxic chemicals, kerosene, paints, thinners, and other finishes or cleaning materials are to be used in a well ventilated room. They are never to be used near an open flame.
47. Never use water to put out an electrical or oil fire, it will cause the fire to spread.
48. In case of fire in the shop: Sound the alarm; FIRE!!, turn off all gas and electricity, put the fire out.



Hand Tools

49. Be sure your hands are as free as possible of dirt, grease, and oil when using tools.
50. Select the right tool for the job to be done. Use the proper type and size hand tool for the job.
51. Make sure when using a sharp-edged tool to point the edge away from yourself and classmates.
52. When carrying tools in the hands, keep the cutting edge or point directed toward the floor.
53. Clamp small work on a bench or in a vise when using a hacksaw, a screwdriver, or when performing delicate operations.
54. Never use a chisel, punch, or hammer with a "mushroomed" head. Chips may fly off and injure someone.
55. Never use a file without a handle. Be sure that the handle is properly secured to the file.
56. Pass tools to classmates with the handles first.

Name: _____

Date: _____

Period: _____

72. Keep rags away from machines that are in operation.
73. Make sure everyone is clear of the machine before starting it.
74. Have the instructor check all special set-ups and new operations before turning on the machine.
75. Think about your job while operating a machine. It is dangerous to talk when you are using power equipment.
76. Have machine at a dead stop, power off, before cleaning, oiling or repairing. Always turn the power off before leaving a machine.
77. Use only electric power tools that are grounded, or that have UL approved housings.



Safety Zones

78. Only the operator and teacher are permitted within the defined working area around any machine.
79. Do not lean on machines - stand clear.
80. Disturbing another student while he is working is a dangerous practice.



Electrical

81. Consider every electric circuit live until proved otherwise.
82. Make certain your hands are completely dry before touching electrical switches, plugs, or receptacles.
83. Remember even 110 volts can be fatal. Approach all jobs with caution, and analyze each job before you start.
84. The location of emergency power switches shall be known by all students.
85. Never allow anyone to turn power on and off for you while you are working with instruments.
86. Cutting two or more wires at the same time with pliers or other tools is extremely dangerous and may result in damage to the circuit and tools, and severe injury to the person if the power is not turned off.
87. Electricity has no respect for ignorance. Do not apply voltage or turn on any device until it has been properly checked by the instructor.

Date: _____

Period: _____

88. Always stand a safe distance from any project when it is turned on for the first time. Sparks and smoke can be dangerous.
89. Deliberately shorting any electric circuit or generating device may damage the equipment, cause an explosion, or do bodily harm.
90. Certain components such as resistors and vacuum tubes get hot while operating. Wait for them to cool before attempting to remove them.
91. Do not work around electrical equipment if floors are damp or wet.
92. Do not work on an electrical circuit with the power turned on.
93. Be sure equipment is in proper working order before using. Frayed cords and plugs are a major source of accidents.
94. Ask for instructions before using any piece of electronic test equipment. One wrong connection can destroy an instrument and thus deprive you and others of its use until repaired. The repairs can be expensive.
95. Use proper instruments for testing circuits.
96. Before replacing a fuse in any electrical equipment, disconnect the power source.
97. When making temporary or permanent connections, carefully avoid leaving open splices or pieces of wire sticking out. Secure all wires properly. Tape or cover the connections.

LABORATORY SAFETY PROCEDURES

The laboratory safety procedures have been read and explained to me. I agree to abide by these rules, and if I have any questions I will ask the instructor.

Students Signature: _____

Period: _____

Date: _____

Instructors Initial: _____



Name: _____

Date: _____

Period: _____

INFORMATIONAL HANDOUT

ELECTRICAL SHOCK

One of the major hazards in the electronics field is protection against electrical shock. Shock is caused by the passing of electric current through the body. Current flow is related to the voltage applied and therefore the higher the voltage the more serious the shock. Don't however have the idea that low voltages do not shock for they certainly do if the circumstances are right.

Let's see what can happen when an electric current passes through your body. A number of effects may occur depending upon the circumstances and magnitude of the shock.

Current Value

Effect

.001 ampere

Produces a shock that can be felt (Mild "tingling" sensation).

.01 ampere



Produces a severe shock, which is painful, and can cause loss of muscular control. (Can't let go phenomenon).

.1 ampere



Produces a potentially fatal shock which can cause death if current lasts for a second or more.

Name: _____

Date: _____

Period: _____

As you can see, the body is sensitive to relatively small current flows. As a comparison, a common 100 watt light bulb draws a current flow of .85 amperes, far higher than the .1 ampere of current which can cause death.

OTHER EFFECTS OF ELECTRIC SHOCK:

Muscular paralysis-

Burns-

Cessation of breathing-

Unconsciousness-

Ventricular fibrillation-

Cardiac arrest--

All of these effects do not occur with every shock. As stated before, conditions vary. What happens to you depends upon several factors:

- (1) The intensity of the current.
- (2) The frequency of the current.
- (3) The path the current follows through the body.
- (4) How long the current passed through the body?
- (5) Did you expect to be shocked?

Keep in mind, that the current flow through your body, not the amount of voltage applied is the determining factor in the severity of a shock you might receive. The higher the current, the more dangerous the shock.

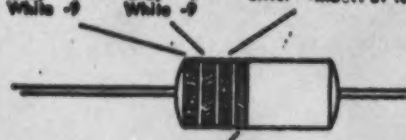
CAUTION: Electric shock can
be hazardous to your health.

PREFIXES and SYMBOLS
of Electrical Units as Adopted by
The National Bureau of Standards

UNIT	PREFIX	SYMBOL
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^2	hecto	h
10^1	deka	dk
10^{-1}	deci	d
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

**Fixed Composition
RESISTORS**

Black	0	Black	0	Black	0
Brown	1	Brown	1	Brown	1
Red	2	Red	2	Red	2
Orange	3	Orange	3	Orange	300
Yellow	4	Yellow	4	Yellow	4000
Green	5	Green	5	Green	50000
Blue	6	Blue	6	Blue	600000
Violet	7	Violet	7	Gold	±1% .01
Grey	8	Grey	8	Silver	±10% .01
White	9	White	9		



Gold ± 5% Tol.
Silver ± 10% Tol.
No Band ± 20% Tol.



TABLE II

Graphic Symbols

Graphic symbols used for electronic diagrams have been developed over the years to portray each component in an unmistakable manner. The symbols which appear here have been compiled and edited by Bishop Graphics from many sources to show those symbols most often used today. Unless otherwise stated below, the symbols are from:

- "Graphic Symbols for Electrical and Electronics Diagrams" (IEEE No. 315, 1971)/(ANSI Y32.2-1970) and
- "Graphic Symbols for Logic Diagrams (Two-State Devices)" (IEEE Std. 91, 1973)/(ANSI Y32.14-1973)

These documents have been approved by the Institute of Electrical and Electronic Engineers (IEEE), the American National Standards Institute (ANSI), the American Society of Mechanical Engineers and the Department of Defense. In addition, IEEE #315 has been approved by the Canadian Standards Association (CSA).

These standards are updated at least every five years by standing committees of the IEEE and ANSI.

TWO STATE LOGIC DEVICES

GATES

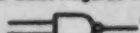
Two-Input

AND Gate



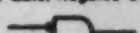
(1)

NAND Gate, Negated Inputs



(1)

NAND Gate, Negated Output



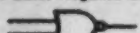
(1)

OR Gate



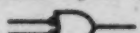
(1)

NOR Gate, Negated Output



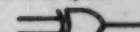
(1)

NOR Gate, Negated Inputs



(1)

Exclusive-OR Gate



(1)

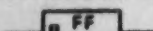
Inverter Gate



(1)

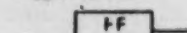
FLIP-FLOPS

R-S (Set-Reset) Flip-Flop



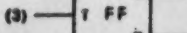
(3)

Toggle Flip-Flop



(1)

J-K Flip-Flop



(3)

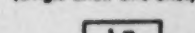
D-Type Flip-Flop



(3)

MONOSTABLE MULTIVIBRATOR

Monostable (Single-Shot, One-Shot)

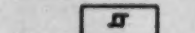


(1)

(3)

SCHMITTRIGGER

General



(1)

SEMICONDUCTORS

TRANSISTORS

NPN Transistor



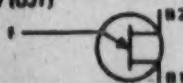
(1)

PNP Transistor



(1)

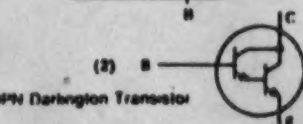
Unijunction Transistor (UJT)
With N-Type Base



Programmable Unijunction Transistor (PUT)
Also SCR With N-Type Gate



Multiple-Emitter NPN Transistor

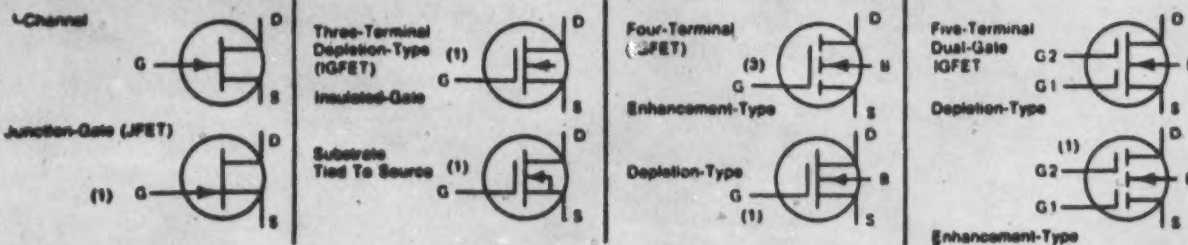


NPN Darlington Transistor

(1) - IEC Approval (2) - Proposed IEEE Revision

SEMICONDUCTORS (CONT'D)

FIELD EFFECT TRANSISTORS (FETs)

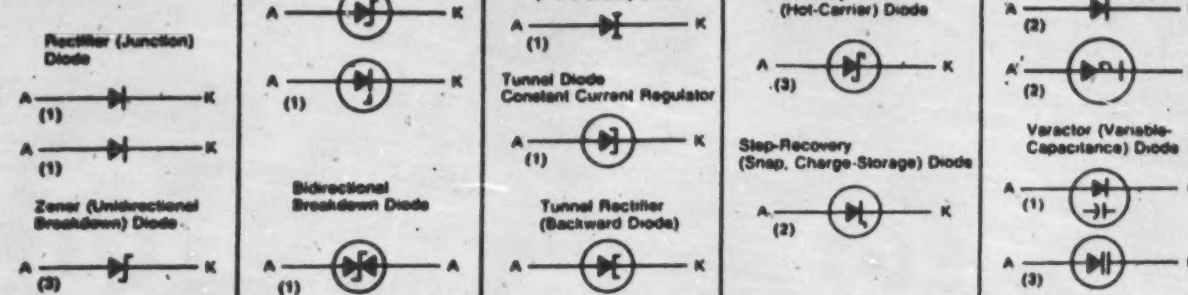


Note: For P-Channel, Reverse Direction Of Arrow.

THYRISTORS

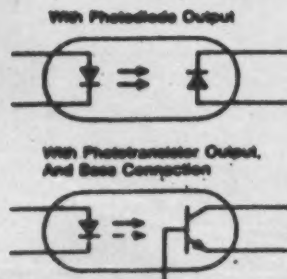


DIODES

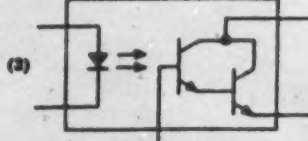


OPTOELECTRONIC DEVICES

OPTICALLY COUPLED ISOLATORS



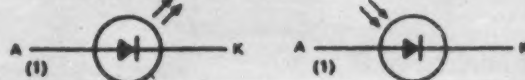
With Photo-Darlington Output, And Base



DIODES

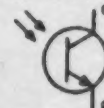
Light-Emitting Diode (LED)

Photodiode



TRANSISTORS

NPN Phototransistor, No Base Connection



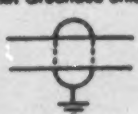
NPN Phototransistor, With Base Connection



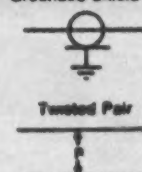
TRANSMISSION PATH

CABLE

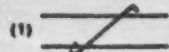
Two-Conductor Cable With Grounded Shield



Coaxial Cable With Grounded Shield

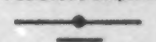


Twisted Pair

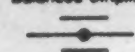


STRIPLINE

Unbalanced Stripline

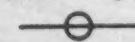


Balanced Stripline

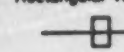


WAVEGUIDE

Circular Waveguide

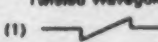
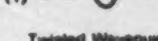


Rectangular Waveguide



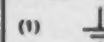
Flexible Waveguide

(1) Twisted Waveguide

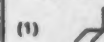


GROUND

Earth Ground



Chassis Or Frame Connection



(3) = Popular Industry Usage

GRAPHIC SYMBOLS TABLE II (CONT'D)

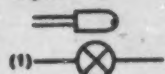
FUNDAMENTAL CIRCUIT COMPONENTS

LAMPS

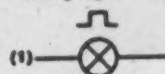
Incandescent Lamp



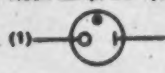
Signal Lamp



Flashing Signal Lamp



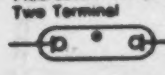
Neon Lamp, DC Type



Neon Lamp, AC Type



Fluorescent Lamp, Two Terminal



AUDIO DEVICE

Loudspeaker

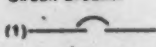


CIRCUIT PROTECTORS

Fuse

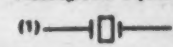


Circuit Breaker



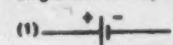
CRYSTAL

Piezoelectric Crystal

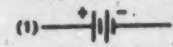


BATTERIES

Single-Cell Battery



Multiple-Cell Battery



SOURCES

Constant-Voltage



Constant-Current



AC Oscillator



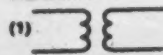
Magnetic-Memory Core

Words Are For Explanation Not Part Of The Symbol.

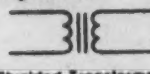


TRANSFORMERS

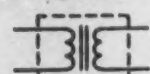
Transformer



Transformer With Magnetic Core

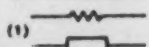


Shielded Transformer With Magnetic Core

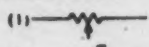


RESISTORS

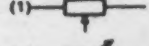
Fixed-Value Resistor



Variable Resistor



Voltage-Sensitive Resistor (Varistor)

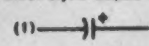


CAPACITORS

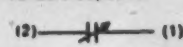
Fixed-Value Capacitor



Electrolytic Capacitor

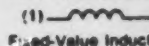


Variable Capacitor

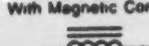


INDUCTORS

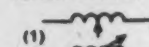
Fixed-Value Inductor



Fixed-Value Inductor With Magnetic Core

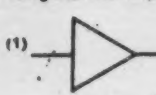


Variable Inductor

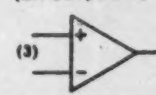


AMPLIFIERS

Single-Ended Amplifier



Differential Amplifier (OR Comparator)



TERMINALS AND CONNECTORS

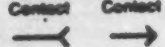
TERMINALS

Terminal Board Or Terminal Strip, With 4 Terminals Shown: Group of 4 Terminals

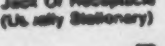


CONNECTORS

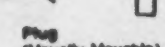
Female Contact



Male Contact



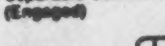
Jack Or Receptacle (Usually Stationary)



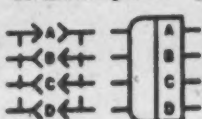
Plug (Usually Movable)



Separable Connectors (Engaged)

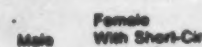


4-Conductor Connectors (Engaged) With Individual Contact Designations



TEST BLOCK

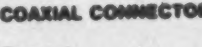
With Terminals Shown



Male



Female With Short-Circuiting Bar



COAXIAL CONNECTOR

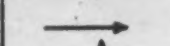
Engaged



CONTACTS, SWITCHES, AND RELAYS

CONTACTS

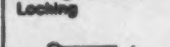
Fixed Relay Contact



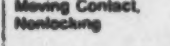
Fixed Switch Contact



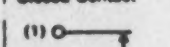
Moving Contact, Locking



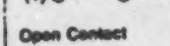
Moving Contact, Nonlocking



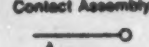
Closed Contact



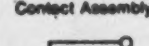
Open Contact



Make-Before-Break Contact Assembly

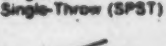


Break-Before-Make Contact Assembly

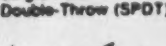


SWITCHES

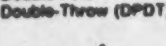
Single-Pole Single-Throw (SPST)



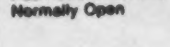
Single-Pole Double-Throw (SPDT)



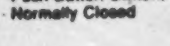
Double-Pole Double-Throw (DPDT)



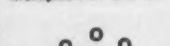
Push-Button Switch, Normally Open



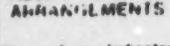
Push-Button Switch, Normally Closed



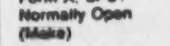
Multiposition Switch



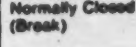
RELAY CONTACT ARRANGEMENTS



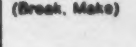
Form A, SPST Normally Open (Make)



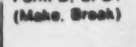
Form B, SPST Normally Closed (Break)

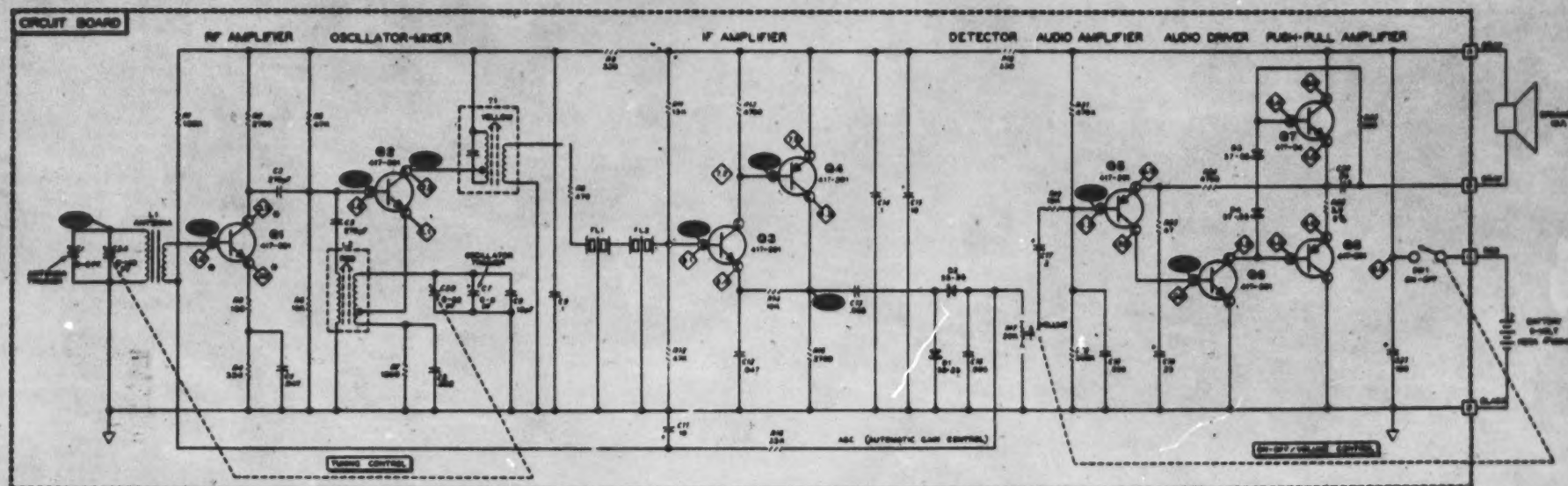


Form C, SPDT (Break, Make)



Form D, SPDT (Make, Break)





SCHEMATIC OF THE
HEATHKIT[®]
AM PORTABLE RADIO
MODEL GR-100B

FRACTIONS AND DECIMAL EQUIVALENTS

$\frac{1}{16}$ — .0156	$\frac{1}{16}$ — .5156
$\frac{1}{8}$ — .0312	$\frac{1}{8}$ — .5312
$\frac{3}{16}$ — .0468	$\frac{3}{16}$ — .5468
$\frac{1}{4}$ — .0625	$\frac{1}{4}$ — .5625
$\frac{5}{16}$ — .0781	$\frac{5}{16}$ — .5781
$\frac{3}{8}$ — .0937	$\frac{3}{8}$ — .5937
$\frac{7}{16}$ — .1093	$\frac{7}{16}$ — .6093
$\frac{1}{2}$ — .125	$\frac{1}{2}$ — .625
$\frac{9}{16}$ — .1406	$\frac{9}{16}$ — .6406
$\frac{5}{8}$ — .1562	$\frac{5}{8}$ — .6562
$\frac{11}{16}$ — .1718	$\frac{11}{16}$ — .6718
$\frac{3}{4}$ — .1875	$\frac{3}{4}$ — .6875
$\frac{13}{16}$ — .2031	$\frac{13}{16}$ — .7031
$\frac{7}{8}$ — .2187	$\frac{7}{8}$ — .7187
$\frac{15}{16}$ — .2343	$\frac{15}{16}$ — .7343
1 — .25	1 — .75
$\frac{1}{16}$ — .2656	$\frac{1}{16}$ — .7656
$\frac{1}{8}$ — .2812	$\frac{1}{8}$ — .7812
$\frac{3}{16}$ — .2968	$\frac{3}{16}$ — .7968
$\frac{1}{4}$ — .3125	$\frac{1}{4}$ — .8125
$\frac{5}{16}$ — .3281	$\frac{5}{16}$ — .8281
$\frac{3}{8}$ — .3437	$\frac{3}{8}$ — .8437
$\frac{7}{16}$ — .3593	$\frac{7}{16}$ — .8593
$\frac{1}{2}$ — .375	$\frac{1}{2}$ — .875
$\frac{9}{16}$ — .3906	$\frac{9}{16}$ — .8906
$\frac{5}{8}$ — .4062	$\frac{5}{8}$ — .9062
$\frac{11}{16}$ — .4218	$\frac{11}{16}$ — .9218
$\frac{3}{4}$ — .4375	$\frac{3}{4}$ — .9375
$\frac{13}{16}$ — .4531	$\frac{13}{16}$ — .9531
$\frac{7}{8}$ — .4687	$\frac{7}{8}$ — .9687
$\frac{15}{16}$ — .4843	$\frac{15}{16}$ — .9843
1 — .5	1 — 1

OHM'S LAW			
VOLTS (E)	OHMS (R)	AMPERES (I)	WATTS (W)
$E = IR$	$R = E/I$	$I = E/R$	$W = EI$
$E = \sqrt{WR}$	$R = E^2/W$	$I = W/E$	$W = I^2R$
$E = W/I$	$R = W/I^2$	$I = \sqrt{W/R}$	$W = E^2/R$

DRILL SIZES — DECIMAL EQUIVALENTS

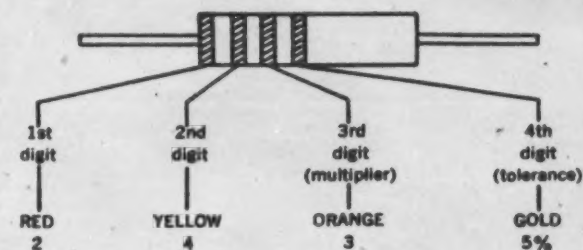
Drill Size	Decimal Equivalent	Drill Size	Decimal Equivalent	Drill Size	Decimal Equivalent
80	.0135	$\frac{1}{8}$	.1250	O	.3160
79	.0145	30	.1285	P	.3230
$\frac{1}{16}$	.0156	29	.1360	$\frac{1}{8}$	.3281
78	.0160	28	.1405	O	.3320
77	.0180	$\frac{1}{8}$	.1406	R	.3390
76	.0200	27	.1440	$\frac{1}{16}$	.3437
75	.0210	26	.1470	S	.3480
74	.0225	25	.1495	T	.3580
73	.0240	24	.1520	$\frac{1}{8}$	.3594
72	.0250	23	.1540	U	.3680
71	.0260	$\frac{1}{8}$	.1562	V	.3750
70	.0280	22	.1570	W	.3770
69	.0292	21	.1590	W	.3860
68	.0310	20	.1610	$\frac{1}{16}$	.3906
$\frac{1}{8}$	.0313	19	.1660	X	.3970
67	.0320	18	.1695	Y	.4040
66	.0330	$\frac{1}{8}$	.1719	$\frac{1}{8}$	.4062
65	.0350	17	.1730	Z	.4130
64	.0360	16	.1770	$\frac{1}{16}$	.4219
63	.0370	15	.1800	$\frac{1}{8}$	.4375
62	.0380	14	.1820	$\frac{1}{16}$	.4531
61	.0390	13	.1850	$\frac{1}{8}$	.4687
60	.0400	$\frac{1}{8}$	.1875	$\frac{1}{16}$	.4843
59	.0410	12	.1890	$\frac{1}{8}$	.5000
58	.0420	11	.1910	$\frac{1}{16}$	.5156
57	.0430	10	.1935	$\frac{1}{8}$	.5313
56	.0465	9	.1960	$\frac{1}{16}$	.5469
$\frac{1}{4}$	.0469	8	.1990	$\frac{1}{8}$	.5625
55	.0520	7	.2010	$\frac{1}{16}$	.5781
54	.0550	$\frac{1}{8}$	.2031	$\frac{1}{8}$	.5937
53	.0595	6	.2040	$\frac{1}{16}$	.6094
$\frac{1}{8}$	.0625	5	.2055	$\frac{1}{8}$	.6250
52	.0635	4	.2090	$\frac{1}{16}$	.6406
51	.0670	3	.2130	$\frac{1}{8}$	.6562
50	.0700	$\frac{1}{8}$	.2187	$\frac{1}{16}$	.6719
49	.0730	2	.2210	$\frac{1}{8}$	.6875
48	.0760	1	.2280	$\frac{1}{16}$	.7031
$\frac{1}{8}$	.0781	A	.2340	$\frac{1}{8}$	.7187
47	.0785	$\frac{1}{8}$	.2344	$\frac{1}{16}$	.7344
46	.0810	B	.2380	$\frac{1}{8}$	.7500
45	.0820	C	.2420	$\frac{1}{16}$	.7656
44	.0860	D	.2460	$\frac{1}{8}$	.7812
43	.0890	$\frac{1}{8}$	.2500	$\frac{1}{16}$	.7969
42	.0935	F	.2570	$\frac{1}{8}$	.8125
$\frac{1}{4}$	.0937	G	.2610	$\frac{1}{16}$	.8281
41	.0960	$\frac{1}{8}$	.2656	$\frac{1}{8}$	.8437
40	.0980	H	.2660	$\frac{1}{16}$	.8594
39	.0995	I	.2720	$\frac{1}{8}$	.8750
38	.1015	J	.2770	$\frac{1}{16}$	.8905
37	.1040	K	.2811	$\frac{1}{8}$	.9062
36	.1065	$\frac{1}{8}$	.2812	$\frac{1}{16}$	.9219
$\frac{1}{8}$	.1093	L	.2900	$\frac{1}{8}$	.9375
35	.1100	M	.2950	$\frac{1}{16}$	.9531
34	.1110	$\frac{1}{8}$	.2968	$\frac{1}{8}$	.9687
33	.1130	N	.3020	$\frac{1}{16}$	.9844
32	.1160	$\frac{1}{8}$	.3125	1	1.0000
31	.1200				

COLOR CODE

COLOR	ABBREV.*	NO.	MULTIPLIER	TOL. $\pm$ %
BLACK	(BLK) BK	0		
BROWN	(BRN) BR	1	10	
RED	(RED) R	2	100	
ORANGE	(ORN) O	3	1000	
YELLOW	(YEL) Y	4	10 ⁴	CATHODE
GREEN	(GRN) GN	5	10 ⁴	
BLUE	(BLU) BL	6	10 ⁴	ANODE
VIOLET OR PURPLE	(VIO) V (PR) P	7	10 ⁴	
GRAY	(GY) GY	8	10 ⁴	
WHITE	(WHT) W	9	10 ⁴	
GOLD			.1	5%
SILVER			.01	10%
NO COLOR				20%

*ABBREVIATIONS shown in brackets are MILITARY STANDARDS.
*ABBREVIATIONS not shown in brackets were made up specifically for this exercise book.

EXAMPLE: Resistor value by COLOR

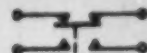
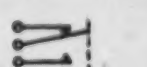


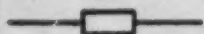
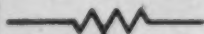
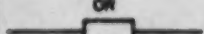
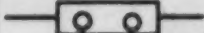
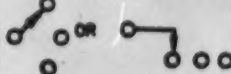
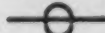
Answer: 24000 or 24K, $\pm$ 5%

(K = 1000, M = 1000000)

COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.	COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.
AMPLIFIER Two inputs		AR		Crossing not connected			
ANTENNA General				Junction (avoid if possible. Use next symbol)			
Dipole		E		Junction			
BATTERY One cell				CONNECTOR Male pin			
Multicell		BT		Female Socket			
CAPACITOR General			85	Separable connectors (engaged)			
Polarized (electrolytic)		C	86, 94	Engaged 4-conductor connectors. Letters or numerals need not be alphabetical or numerical in order.		P J	
Variable or Adjustable							
CONDUCTOR Wiring (general)						P	
Cable, 1 or more conductors				Coaxial connector, build-up example. R-F connector (plug)		P	
COMPONENT SYMBOLS				APPENDIX A			
				PAGE 2			

COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.	COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.
CONNECTOR Mating coaxial				INDUCTOR General			
Two-conductor (Jack)		J		Magnetic core		L	
Two-conductor (Plug)		P		Tapped			
Power, female contacts (2 conductors)				Adjustable			
Power, male contacts				LAMP General			
CRYSTAL Piezoelectric		Y	93	AC type, neon		DS	
FUSE		F	93	Incandescent filament			
GROUND Wire is bonded to chassis.				MACHINE, ROTATING General			
Chassis or frame connection.				Generator		G	
				Motor		B	
				MICROPHONE		MK	
COMPONENT SYMBOLS				APPENDIX A			
				PAGE 3			

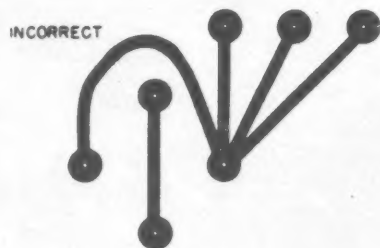
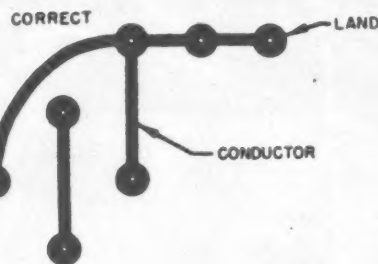
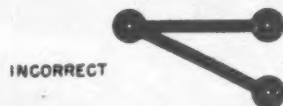
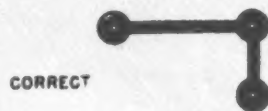
COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.	COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.		
METER (INSTRUMENTS) General		M		RELAY		K			
Example: milliammeter				Contactor (old style)					
RECTIFIER Semiconductor rectifier diode		CR	87	Contactor					
Breakdown diode, unidirectional				Double-pole double-throw (DPDT) (old style)					
Breakdown diode, bidirectional			87						
Tunnel diode			87	Double-pole double-throw (DPDT)					
COMPONENT SYMBOLS				APPENDIX A					
				PAGE 4					

COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.	COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.
RESISTOR				SWITCH			
General	 OR 		88, 89	Single-Throw (ST)			
Tapped	 OR 			Double-throw (DT)			90, 95
Adjustable	 OR 	R	90	Double-pole, Double-throw (DPDT)			
Variable	 OR 			Push-button		S	
Shunt				Selector			
				Wafer, 3 poles, 3 circuits with 2 nonshorting and 1 shorting moving contacts.			
SHIELDED CONDUCTOR				TERMINAL BOARD			
Single conductor				Group of 4 terminals		TB	
Five-conductor cable, shield grounded				TRANSFORMER			
				General			93
				Magnetic core		T	
SPEAKER				Tapped			
General		LS					
COMPONENT SYMBOLS				APPENDIX A			PAGE 5

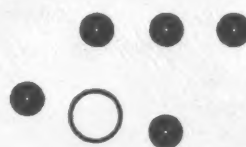
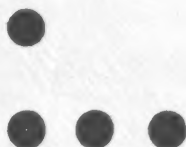
COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.	COMPONENT	SYMBOL	REF. DESIG.	APPENDIX B PAGE NO.
TRANSISTOR				TUBE			
PNP type		Q	91 ↑ ↓ 91	Triode		V	92
PNP type with 1 electrode connected to envelope				Twin triode			
NPN type				TUBE ENVELOPE			
Unijunction N-type base				General			
Unijunction P-type base				Split			
Field-effect N-type base				Gas-filled			
				C.R.T.			
				WAVEGUIDE		W	
				Circular			
				Rectangular			
COMPONENT SYMBOLS				APPENDIX A			
				PAGE 6			

PRINTED CIRCUIT PATTERN

The length of the conductors between various lands shall be held to a minimum.



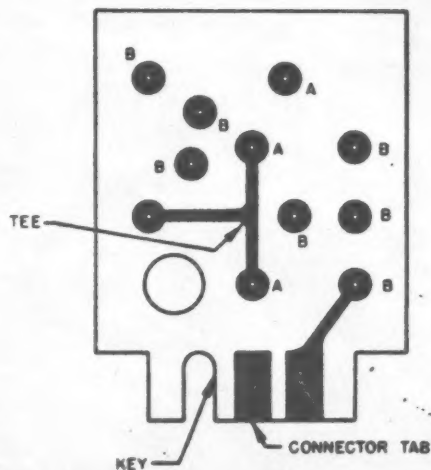
Exercise 1: Connect the lands given in Figs. 1, 2, and 3 with a $\frac{1}{16}$ " wide black pressure-sensitive tape. Leave $\frac{1}{8}$ " minimum spacing from edge of board and component holes. If no tape is available, use pencil and draw the conductors $\frac{1}{16}$ " wide (A tee, see Fig. 4, with fillets is optional.)



Exercise 2: With a $\frac{1}{16}$ " wide tape connect the following in Fig. 4.

All lands marked A join together.
All lands marked B join together.
Connect nearest A hole to remaining connector tab (as shown with B hole to tab).

Make all connections on one side of board only, as shown, and keep the length of the conductors to a minimum.



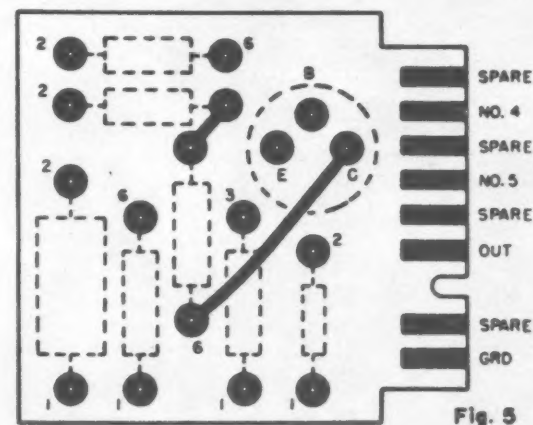
Exercise 3: With a $\frac{1}{16}$ " wide tape connect the following in Fig. 5:

All 1 lands together to Grd (ground).
All 2 lands together to Out.
All 6 lands together.

Connect transistor as follows:

Base B to No. 4 tab.
Collector C to No. 5 tab.
Emitter E to land 3.

Avoid sharp corners.



TITLE

PRINTED CIRCUIT BOARD-PRINTED CIRCUIT PATTERN

DWG. NO.

PCB-1

NAME

DATE

COURSE

GRADE

SCALE

2 X SIZE

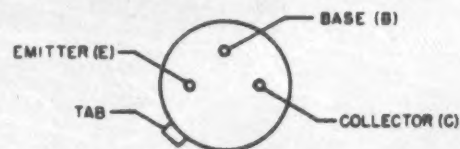
SHEET 1 OF 2

PAGE

8

TRANSISTOR AND DIODES IN PRINTED CIRCUIT BOARD (PCB)

Special attention should be given to laying out transistors and diodes in printed circuit boards. Transistor leads look different when viewed from the bottom (view a) than when viewed from the top (view b), as shown in Fig. 1.



(a) Leads are seen solid.



(b) Leads are seen dotted.

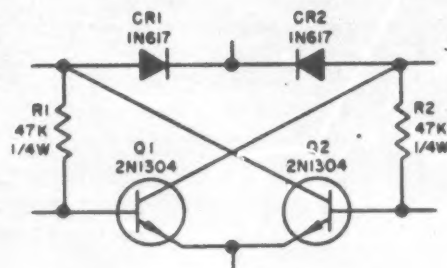
FIG. 1

The secret lies in the tab of the transistor. The emitter (E) is closest to the tab of the transistor. The diode is easier to lay out. Always observe in the schematic to which side the cathode  is pointed. In the layout

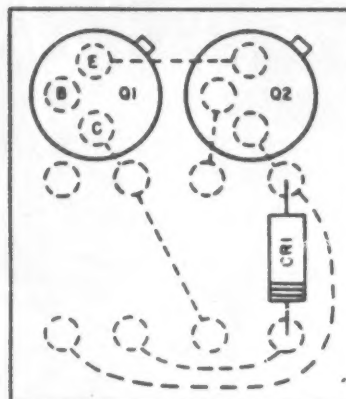
the diode should be installed in its proper orientation  or . It is important that the polarity of the diode be shown.

Exercise: From the schematic shown below make a layout of the components as seen from the top of the board (the circuit will be dotted) and as seen from the circuit side (the components will be seen dotted). Show all missing components and lines. Show transistor tabs in bottom view. Lay out one component lead per land. Component outline will be found in Appendix B.

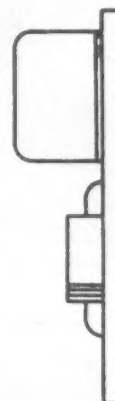
SCHEMATIC DIAGRAM



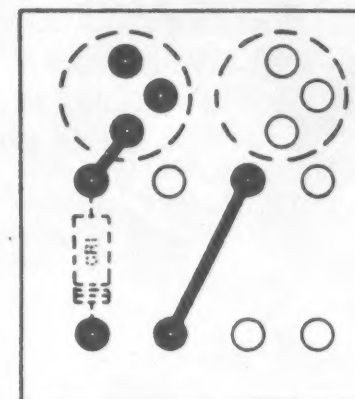
TOP VIEW
(component side)



SIDE VIEW



BOTTOM VIEW
(circuit side)



TITLE

PRINTED CIRCUIT BOARD—TRANSISTORS AND DIODES

DWG. NO.

PCB-1

NAME

DATE

COURSE

GRADE

SCALE

2 X SIZE

SHEET 2 OF 2

PAGE

9

A TYPICAL, SINGLE-SIDED PCB (Printed circuit board)

STEP-BY-STEP FABRICATION

Printed circuit boards are fabricated in five principal steps, requiring five types of drawings:

1. Schematic 2. Layout 3. Master (Artwork) 4. Drill & Contour and 5. Assembly with List of Materials.

From specifications on a Schematic as shown at the upper right, a Layout started at the lower right can be drawn using components outlines similar to Appendix B.

Given: Schematic at right with component outline and Appendix B.

Problem: Prepare the drawings required to fabricate a PCB. Mount all components on a single-sided board 1.0 x 1.0 x .062 thick, and provide three PAN HEAD (#2-56 thread) SCREWS for installation.

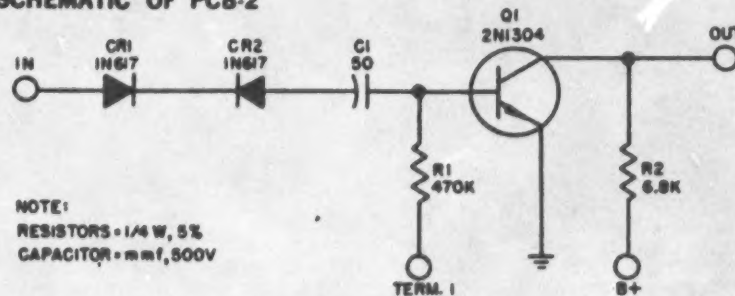
Solution: Steps 1 and 2 are described at right while steps 3 through 5 are developed on page 39 & 40.

HOW TO PREPARE THE LAYOUT

Lay out your board and components double size for photographing. Remember that the transistor is viewed from top (see previous exercise). In dotted line or red pencil show the conductors between lands. Show the screw head, three places. Mark components and polarity of diodes as shown. Always make a neat, accurate layout.

The layout should show screws (as shown in PCB-2) or any other fastener which will occupy space on the P.C. Board and displace circuitry or component area. Although the screws have to be shown in the layout, they are not considered part of the assembly and should not appear in the List Of Materials.

SCHEMATIC OF PCB-2



NOTE:

RESISTORS - 1/4 W, 5%

CAPACITOR - .001, 500V

Step 1: SCHEMATIC (PCB-2)

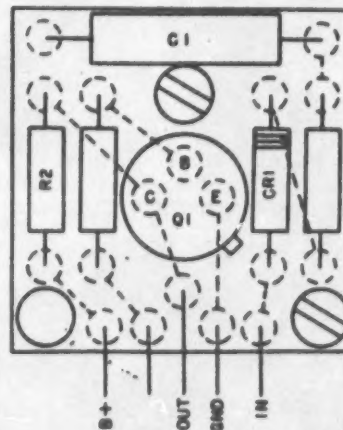
Always draw the schematic first. Since this is a Sample Exercise, the schematic is shown completed.

Step 2: LAYOUT EXERCISE (PCB-2)

Complete the Layout.

1. How many electrical components are there? _____

LAYOUT OF PCB-2



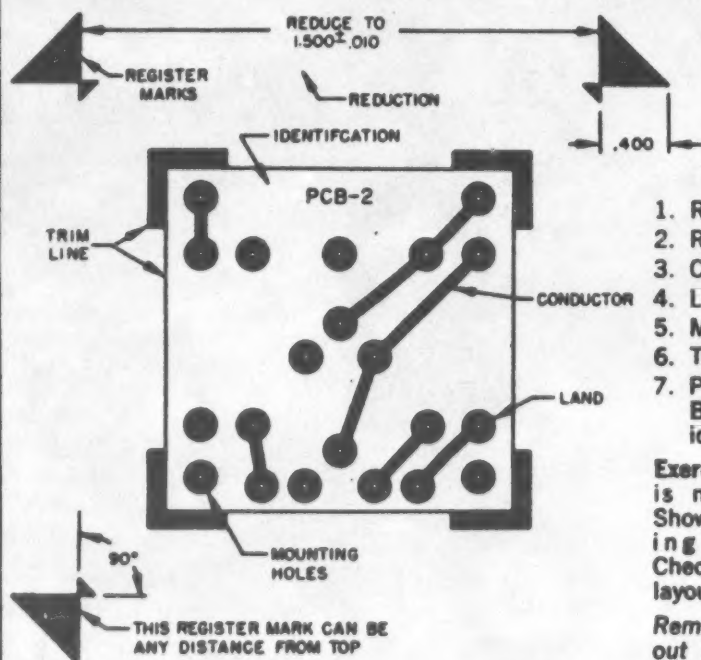
2. Two components are not identified. Show them in the layout. (See schematic diagram.)
3. Show polarity of all diodes.
4. One screw head is not shown finished. Complete it.
5. Identify all leads coming out of the board.
6. Check your layout against the schematic and fill in the missing dotted line.

TITLE PRINTED CIRCUIT BOARD—SCHEMATIC AND LAYOUT (SINGLE SIDED)					DWG. NO. PCB-2	
NAME	DATE	COURSE	GRADE	SCALE 2 X SIZE	SHEET 1 OF 3	PAGE 40

Step 3: PCB MASTER (Artwork)

Generally, the layout made in Step 2 is turned over and a sheet of mylar is placed on the reverse side. The layout is usually made on semitransparent vellum whose PCB pattern is visible from the back side through the mylar. The PCB pattern is now duplicated on the mylar with black tape conductors and/or decal lands. If you had made a master of PCB-2, it would be similar to the sample shown below.

The master (artwork) should show the following:



1. Reduction
2. Register marks
3. Conductors
4. Lands
5. Mounting holes
6. Trim line
7. Printed Circuit Board identification

Exercise. The sample is not completed. Show the two missing conductors. Check against your layout, Step 2.

Remember: your layout is inverted with respect to your master.

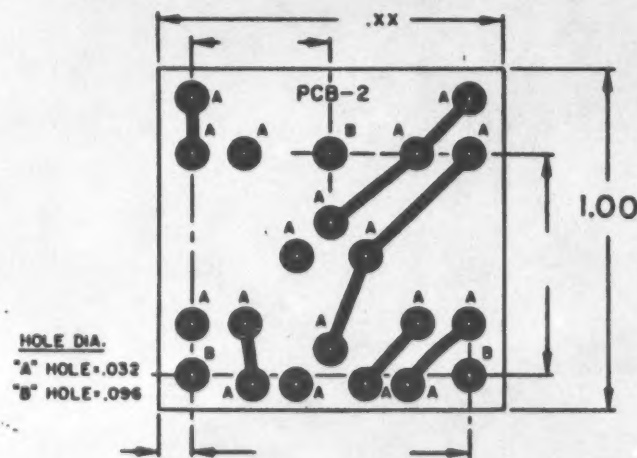
Step 4: PRINTED CIRCUIT BOARD DRILLED (PCB-2)

This step is needed so that the printed circuit board can be fabricated after the etching is done. Include the following data in all exercises to come:

1. Show all hole-diameter callouts.
2. Show board mounting hole center dimensions.
3. Show the shape and size of finished board dimensions.
4. **Material:** .062 thick Epoxy glass cloth laminate with .0027 CU one side (CU = copper)
5. **Finish:** Gold flash on etched lettering and conductors.

Exercise: See illustration below.

1. What should the .XX dimension be? _____
2. What are the A holes for? _____
How many A holes are there? _____
3. What are the B holes for? _____
How many B holes are there? _____
4. Complete the missing dimensions.
5. Show the two missing conductors as in step 3.



TITLE PRINTED CIRCUIT BOARD-MASTER AND DRILLED (SINGLE SIDED)					DWG. NO. PCB-2	
NAME	DATE	COURSE	GRADE	SCALE 2 X SIZE	SHEET 2 OF 3	PAGE //

Step 5: PRINTED CIRCUIT BOARD ASSEMBLY (PCB-2)

The following items must be shown:

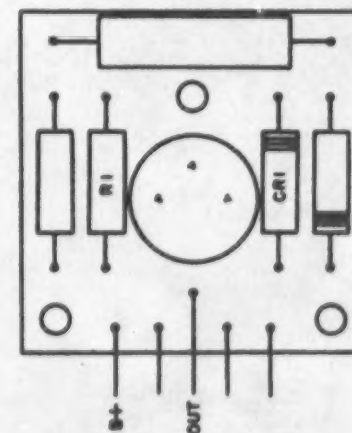
1. Assembly of all components as seen mounted on board. It will be the same as your layout, except that the dotted line and lands will not be seen since it is on the opposite side of the board.
2. All components and identification. Always make it clear so that anyone could assemble the board from your assembly drawings.
3. The assembly drawing should always be accompanied by a complete list of material, as shown below.

7		R2	RESISTOR	6.8K, 1/4W, 5%, RC076F682J
6				
5				
4	2	CR1, CR2	DIODE	
3	1	C1	CAPACITOR	50 MMF, 50V, CM-
2	1	PCB-2	PRINTED BOARD	1.00 x 1.00 x .062 EPOXY GLASS
1	X	-----	SCHEMATIC	SHEET 1 of 3
ITEM	NO. REQ'D	REFERENCE DESIGNATION	DESCRIPTION	MANUFACTURER & PART NO. OR MIL TYPE DESIGNATION

LIST OF MATERIAL

Exercise

1. Complete the assembly drawing below. Show all component identifications.
2. Complete the list of material (see Appendix B and schematic diagram on page 38). Resistors are listed on page 88 (MIL STYLE RC07).
Capacitors are listed on page 86 (MIL TYPE CM-15).
Diodes are listed on page 87.
Transistors are listed on page 91.



TITLE PRINTED CIRCUIT BOARD - ASS'Y AND LIST OF MATERIAL (SINGLE SIDED)					DWG. NO. PCB-2	
NAME	DATE	COURSE	GRADE	SCALE	SHEET 3 OF 3	PAGE 12
				2 X SIZE		

RESULTS OF AN INFOSYSTEMS STUDY

--DID NOT CONSIDER COM OPERATIONS

OVERVIEW ANALYSIS COMPUTER OPERATIONS SALARY ACROSS THE NATION

*Statistics Reviewed: 1,850 Companies
48 Cities
9 Regions

*Source: Infosystems Magazine-June 1977

HIGHEST SALARIES BY REGION

POSITIONS REVIEWED:
Lead Computer Operator
Sr. Computer Operator
Jr. Computer Operator

1. PACIFIC
2. SOUTH ATLANTIC
3. MOUNTAIN
4. EAST SOUTH CENTRAL
5. EAST NORTH CENTRAL
6. MID ATLANTIC
7. NEW ENGLAND
8. WEST SOUTH CENTRAL
9. WEST NORTH CENTRAL

POSITIONS REVIEWED:
Mgr/Supv Computer Operations
Lead Computer Operator
Sr. Computer Operator
Jr. Computer Operator

1. PACIFIC
2. NEW ENGLAND
3. SOUTH ATLANTIC
4. MOUNTAIN
5. EAST SOUTH-CENTRAL
6. EAST NORTH CENTRAL
7. MID ATLANTIC
8. WEST SOUTH CENTRAL
9. WEST NORTH CENTRAL

HIGHEST



LOWEST

HIGHEST SALARIES BY CITY -COMPUTER OPERATIONS POSITIONS

1. Baltimore, Md.
2. Washington, D.C.
3. San Francisco, Ca.
4. Boston, Mass.
5. Memphis, Tenn.
6. Seattle, Wash.
7. Phoenix, Ariz.
8. Los Angeles, Ca.
9. Portland, Ore.
10. Chicago, Ill.

HIGHEST



LOWEST SALARIES BY CITY -COMPUTER OPERATIONS POSITIONS

1. Toledo, Ohio LOW
2. San Antonio, Texas LOWER
3. Philadelphia, Penna. LOWEST

HIGHEST/LOWEST COMPUTER OPERATIONS SALARIES -BY INDUSTRY TYPE

Highest---

1. Public Utilities
2. Transportation
3. Government Agencies
4. Manufacturing

Lowest----

1. Educational
2. Construction-Engineering

NATIONAL AVERAGE SALARIES -BY JOB POSITION

1. Mgr of Data Processing
2. Mgr of Computer Systems Analysts
3. Mgr of Systems Analysis & Pgmng
4. Project Team Leader
5. Asst. Mgr of Data Processing
6. Lead Computer Systems Analyst
7. Data Communications Manager
8. Manager of Programming
9. Lead Computer Sys Analyst & Pgmng
10. Sr. Computer Sys Analyst
11. Sr. Computer Sys Analyst & Pgmng
12. Lead Programmer
13. Mgr of Computer Operations
14. Jr. Computer Systems Analyst
15. Senior Programmer
16. Jr. Computer Sys Analyst & Pgmng
17. Jr. Programmer
18. Lead Computer Operator
19. Computer I/O Control Manager
20. Sr. Computer Operator
21. Key Entry Supervisor
22. Data Communications Operator
23. Programmer Trainee
24. Jr. Computer Operator
25. Tape Librarian
26. Lead Key Entry Operator
27. Sr. Key Entry Operator
28. Jr. Key Entry Operator

(VIEWING A TYPICAL IN-HOUSE COMPUTER DEPARTMENT)

EDP TRENDS:

- MORE PROFESSIONALISM IS REQUIRED OF ALL EDP POSITIONS.
--General Knowledge that Extends Beyond Current Duties and Responsibilities in order to perform well.
- PROGRAMMING (CODING) IS BECOMING SIMPLER.
--Computer firmware on the rise.
- SYSTEMS INTEGRATION (DATA BASE) GROWING AND BECOMING MORE COMPLEX.
- COMPUTER OPERATIONS IS BECOMING MUCH MORE COMPLEX.
- NETWORK SYSTEMS - Infancy & Growing
- DISTRIBUTIVE DP - Infancy & Growing
- INTELLIGENT TERMINALS - Skyrocketing
- WORD PROCESSING - Skyrocketing
- MICROCOMPUTERS -Skyrocketing
- MINICOMPUTERS - Skyrocketing
- OPERATING SYSTEMS REMAIN COMPLEX & GETTING WORSE
- COMPUTERS - Smaller, More Powerful, Cheaper
- EDP Positions becoming more & more specialized.
- APPLICATIONS PROGRAMMING & SYSTEM DESIGN - being emphasized.
- TO THE USER THE FRUSTRATION & COMMUNICATIONS GAP REMAINS.
- COMPUTER OPERATIONS STAFFS - RISING IN STATURE AS RESPONSIBILITIES AND COMPLEXITIES OF THE NEWER MEDIUM TO LARGE SCALE SYSTEMS EVOLVE.

GREATEST NEEDS:

- COMMUNICATIONS
- USER TRAINING/PARTICIPATION
- SYSTEM DOCUMENTATION
- AUDITING OF COMPUTER OPERATIONS & SYSTEM INFORMATION USAGE
- EDP/USER TEAMWORK
- MANAGEMENT RESPECT FOR THE PROFESSIONALISM REQUIRED AT EVERY STAGE OF THE OPERATION (INFORMATION PROCESSING)
- UNDERSTANDING OF PROCESSING & USER REQUIREMENTS (BALANCE) BEFORE A SYSTEM IS SET IN PLACE.

* EXCERPTS FROM *

An Introduction To Personal Computers
A Beginners Guide

by

ROBERT MOODY
OWNER/OPERATOR
BYTE OF. PALO ALTO
2233 EL CAMINO REAL
Palo Alto, California 94306
(415) 327-8080

2nd WESTCOAST COMPUTER FAIRE, MARCH 3,4,5

COPYWRITE 1978

II GLOSSARY OF TERMS — SOFTWARE

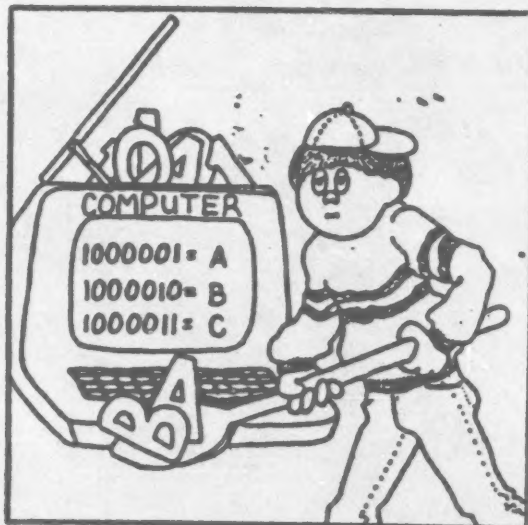
BUZZ WORDS

The first hurdle people have to cross in understanding something new is learning the language. We as a group, computer people, have probably abused the English language more than any other industry. Trying to distinguish ourselves from other groups has put us in the position of having normal English-speaking people try and decipher the jibberish we conduct our conversation in. If it were up to me I would like to change it all back and use terms that everyone would be able to understand and not have to adapt to a complete new way of conversing. I can't do that, so all you folks who are reading this book to gain an insight as to what personal computers are all about, will have to forget the definition of some words that you have learned in school and take up Computeresse. It's not going to be that difficult to do, just deprogram your brain, THINK COMPUTER.

The first group of words deals with the way we talk to our computers. Software, as it is called, is the list of instructions we give to the computer to do a job. It is also the way the computer takes this list and converts it to the language it knows.

ALPHANUMERIC:

Information that is made up of letters (the alphabet) and digits (numbers).

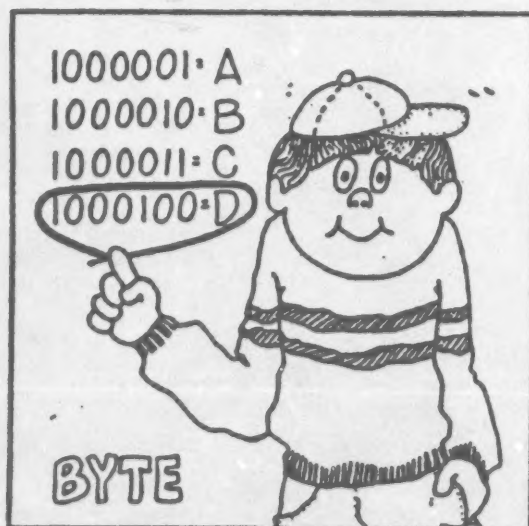


INPUT: The information that goes **IN** to your computer system. The computers "food".

PROGRAM: A list of instructions to the computer, telling it what to do and when to do it.

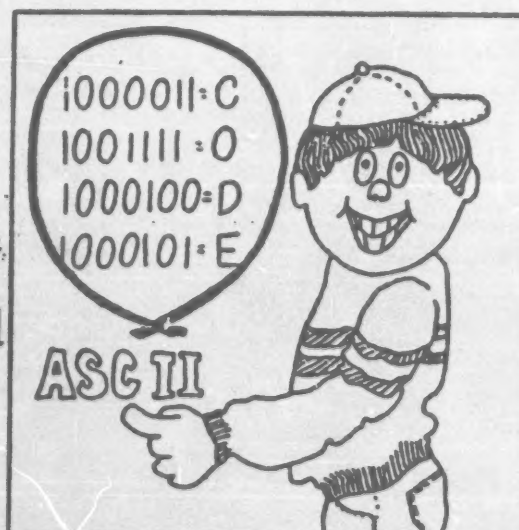


BIT: The smallest unit of measure in a computer word; several bits make up a byte, or a computer word.



BYTE: The space which a letter or digit (one character) takes up in a computer. Space in a computer is measured in bytes. A megabyte is a million bytes.

ASCII: American Standard Code for Information Interchange. This is a seven-bit code that defines letters and numbers that the computer uses as its input.



IV GLOSSARY OF TERMS — HARDWARE

'BUZZ WORDS

Now that we have gone through the basics of how we talk to personal computers, what we will deal with next is the equipment itself. Hardware refers to the parts of a computer system we can actually touch and put our hands on. Much like a stereo system, a computer system is made up of different modules or parts. In a basic stereo system you need a receiver, amplifiers, and speakers. Each working independently cannot produce music, but working together you will get the desired result.

Of course when we talk basics in any system we can always make it bigger and better. You can add things like cassette decks and turntables to have your stereo system do more. In a computer system we can do the same thing.

First of all I need to define the terms we will be dealing with. So put your training hat back on and I will go through some basic hardware terms.

CIRCUIT BOARD:

The basic material is a thin sheet of insulating material that a layer of copper has been bonded to, then a layer of tin goes on next. By using a photographic process, areas of the tin and copper are etched away, leaving thin lines called traces. These traces connect the integrated circuits together.



MOTHERBOARD: This is a printed circuit board that has a specific bus structure that you would plug in many different kinds of printed circuit boards.

BUS: A bus line is a wire that carries an electrical signal to two or more printed circuit boards. A bus structure would be many bus lines that carry many different signals.

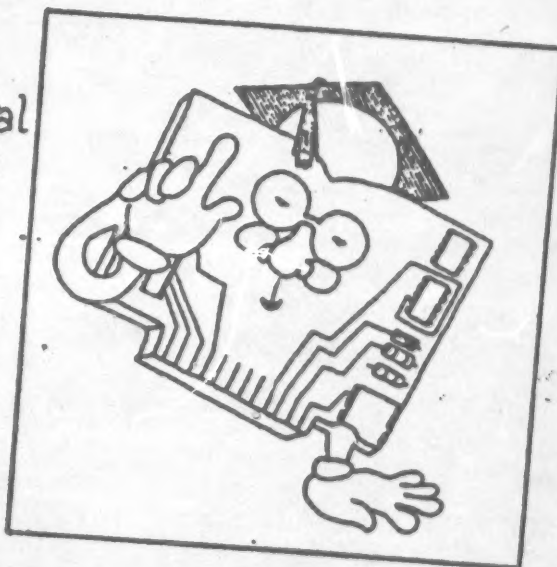




MICRO, MICROCOMPUTER, MICROPROCESSOR:

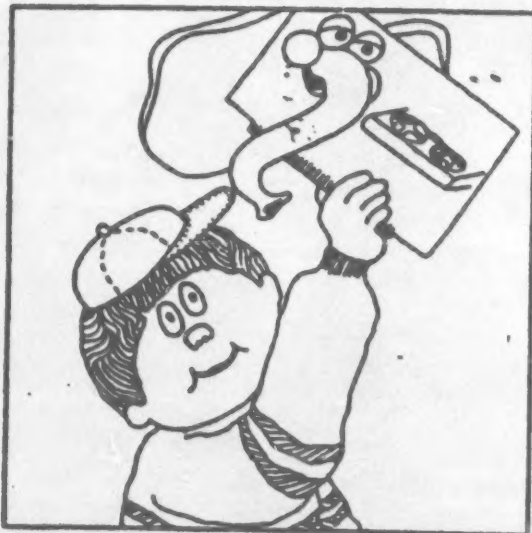
These terms mean the same as the CPU. "Micro" came into being when we learned to make things small. The circuit itself is about the size of a pencil eraser.

CPU: This is the Central Processing Unit or the brain of the computer. This is the part of the computer that thinks.



RAM: Random Access Memory. This is the temporary storage used by your computer to allow you to change the data you have put into it, then it is transferred to a mass storage device.

ROM: Read Only Memory. This is memory also, but it has been programmed to give out the same kind of information all the time, it never forgets.

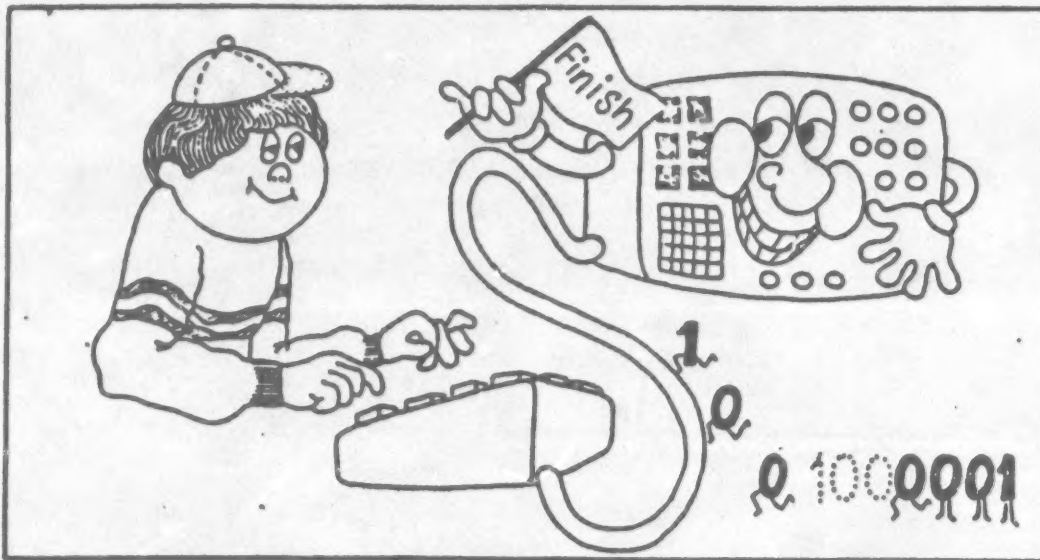


EPROM: Much like ROM, EPROM (Erasable Programmable Read Only Memory) does not forget but has one added feature. You can erase the information you have programmed in it by using an ultraviolet light and reprogram with different information.

INTERFACE or I/O:

A connector that "translates" between two parts of a system. You generally need one interface for each peripheral, to hook it to your computer.

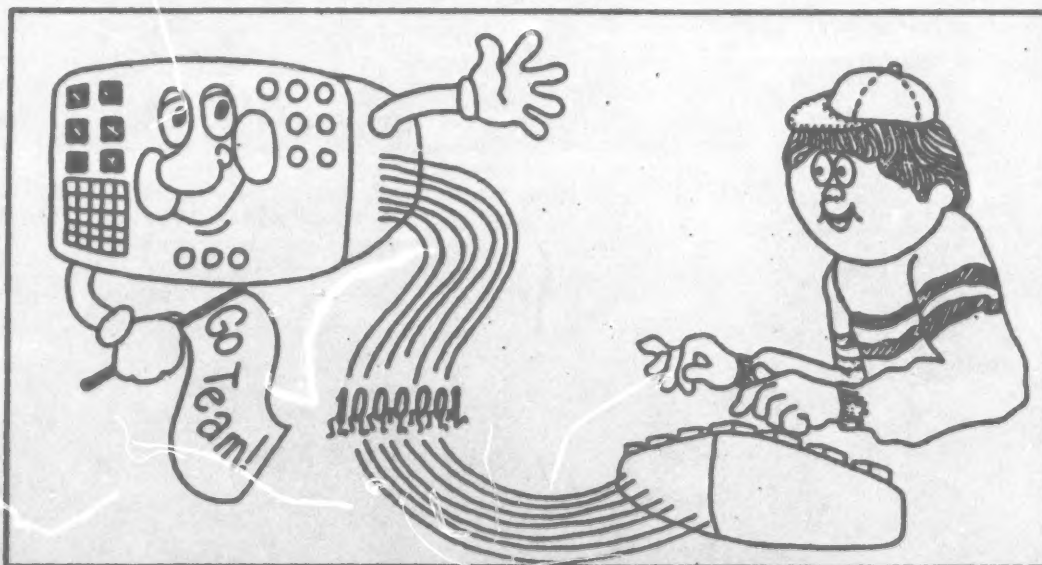




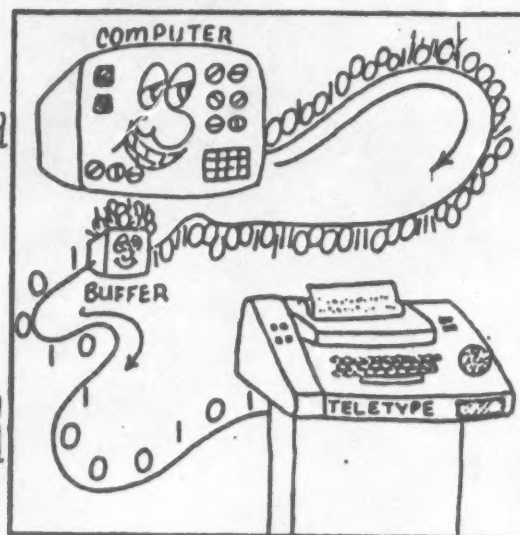
SERIAL I/O: This type of interface transmits and receives data to and from the CPU through a single stream of electrical signals. Serial transmission is used when the requirements to hook up the peripherals to your CPU must travel through low-quality long-distance channels.

BAUD RATE: This is a measurement term used to determine how fast your data is transferred to and from the CPU. The rate is measured in bits per second through a serial I/O.

PARALLEL I/O: This type of interface transmits and receives data on a batch mode, where there are several signals interchanged at the same time. These kinds of transfers can happen very fast, but can't be sent too far.



BUFFER: This is a holding area for information which is used to equalize or balance two different operating speeds. It is used in peripheral devices, for example the output of the computer might be too fast for a printer, so the information would be held in a buffer until the printer could accept the next batch of data to be printed.



PERIPHERALS: The devices attached to your computer, such as the display, keyboard, printer, etc.





MASS STORAGE: Any way of keeping a lot of information **OUTSIDE** your computer, but available to it. This is your computer's "memory." Most common kinds of mass storage are tape and disk.

CASSETTE STORAGE:

In a personal computer we can use an ordinary auto cassette player to store information through a special interface.



FLOPPY DISK: A mass storage device, which uses a flexible platter to store a large amount of information.



HARD DISK: Much like a floppy, a hard disk stores a tremendous amount of information, but its platter is much larger and not so portable.

TERMINAL: A unit for conversing (input or output) with your computer. It has a keyboard, plus display or print-out.

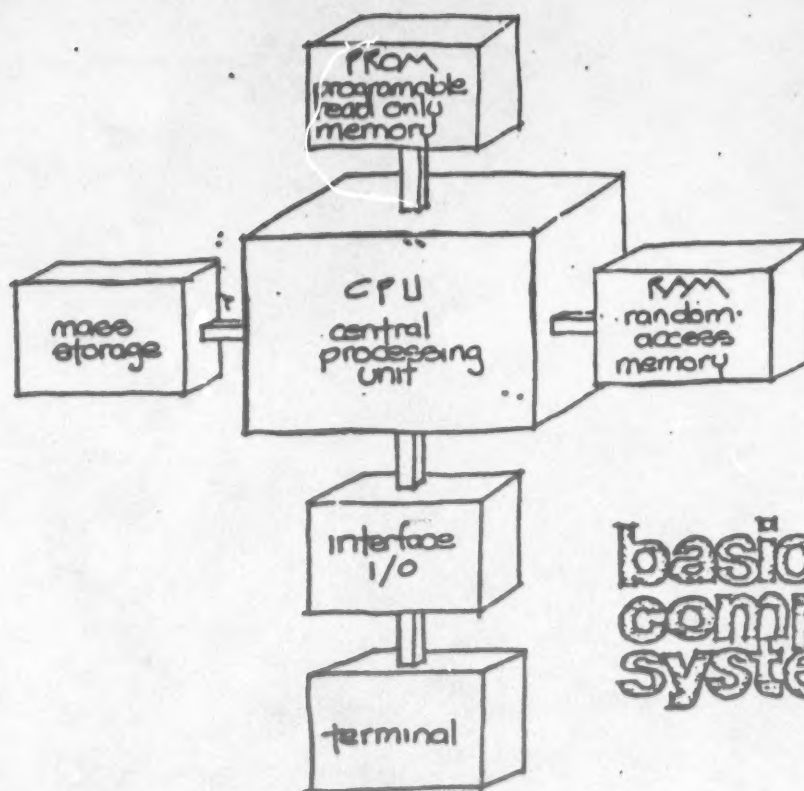
TVT: "Television typewriter." A keyboard and electronics specially designed to turn your TV into a TERMINAL.

CRT: Your computer's "TV screen," showing you what is IN there. The CRT is your computer's way of talking to you. It is also something referred to as a display unit, or terminal.

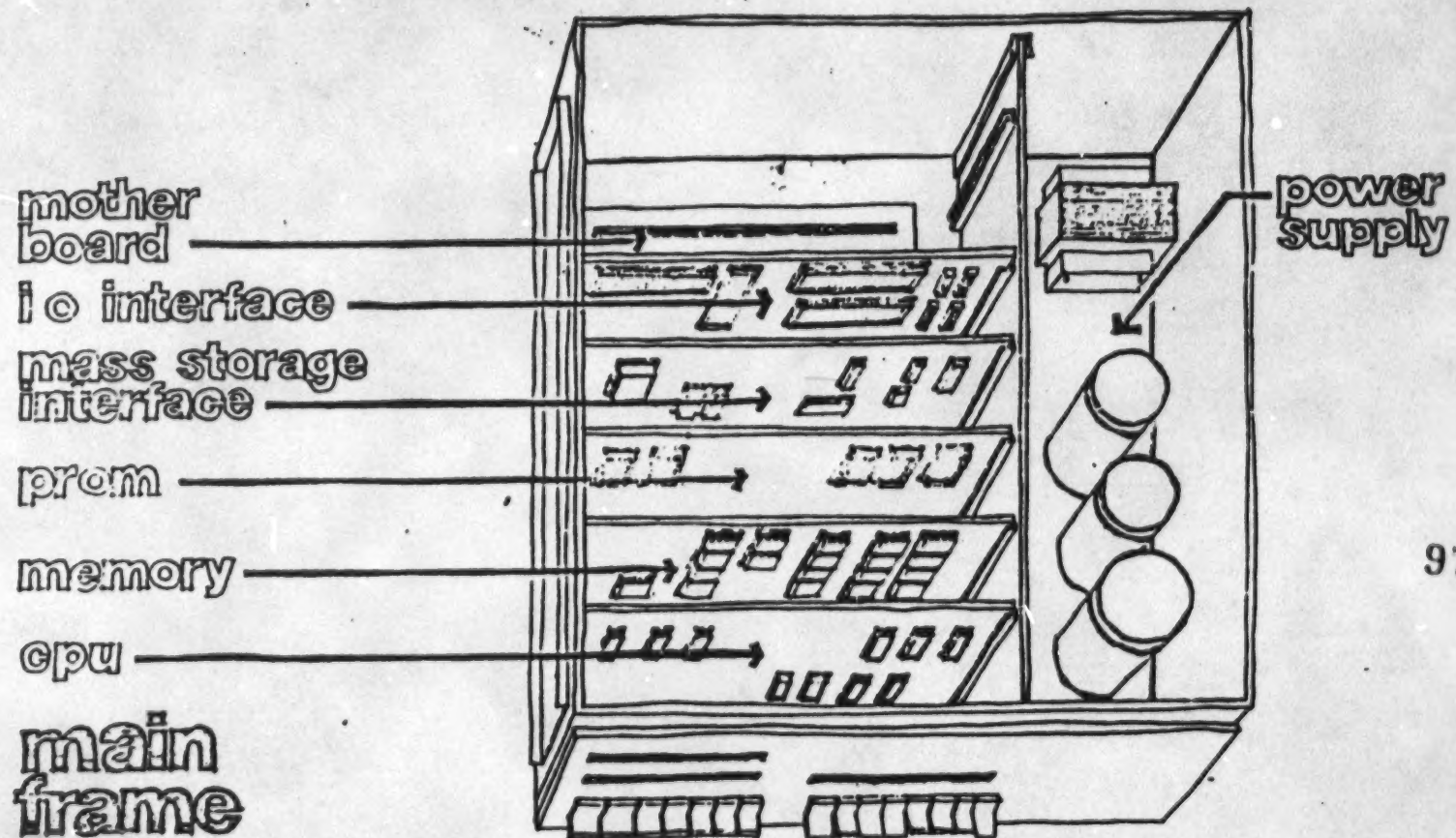




BUG: The cause of a malfunction, usually in a program. They're called "bugs" because they can be hard to find.

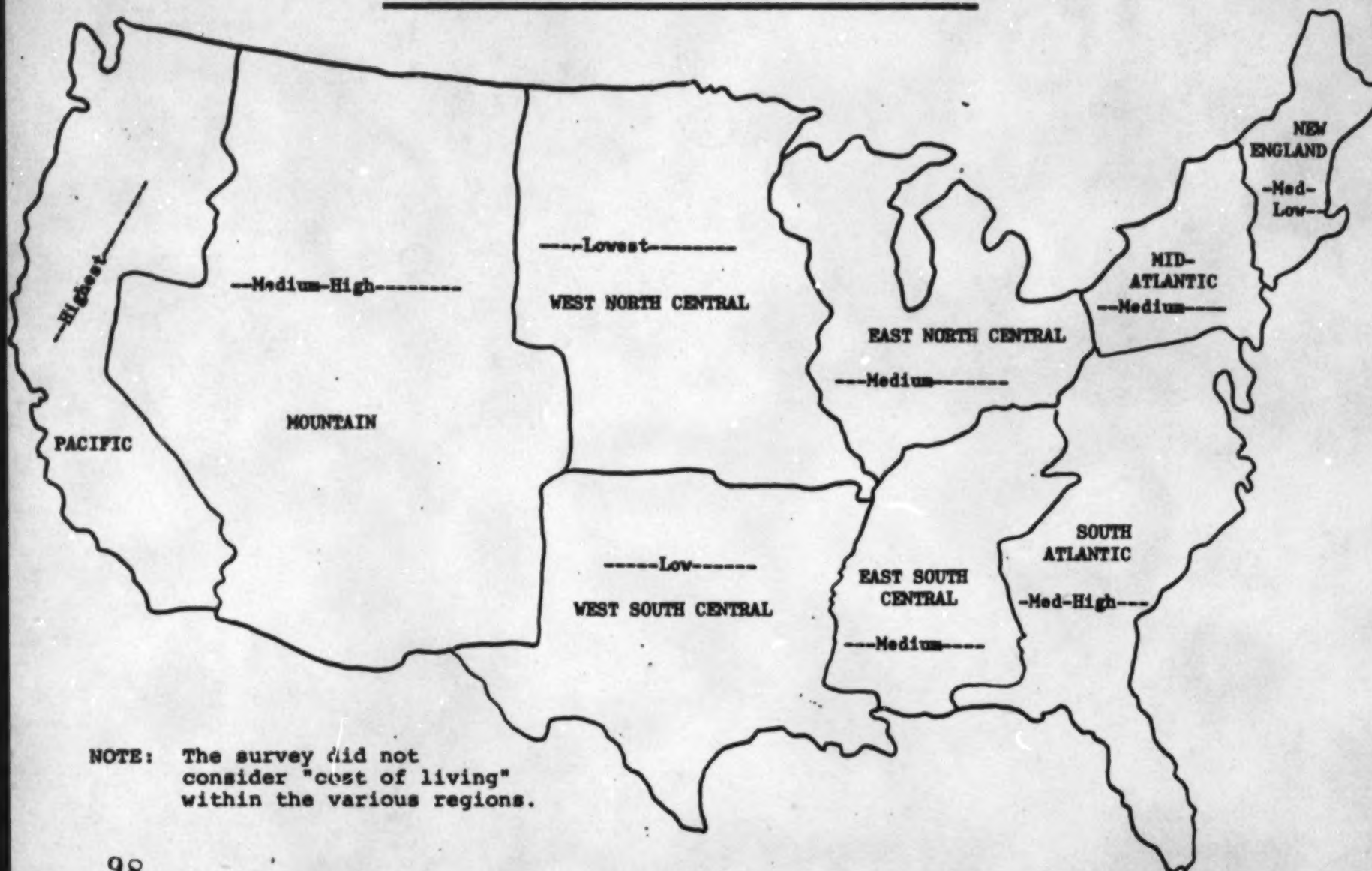


basic
computer
system

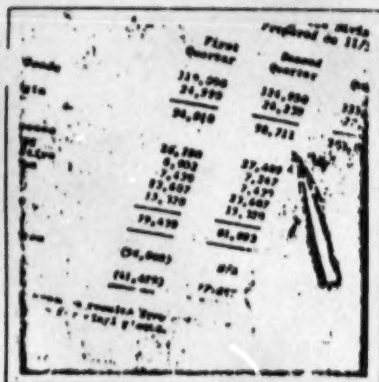


RESULTS OF AN INFOSYSTEMS SURVEY. DID NOT CONSIDER COM OPERATIONS POSITIONS OR SALARIES.

COMPUTER OPERATIONS SALARY CHARACTERISTICS - BY REGION



NOTE: The survey did not consider "cost of living" within the various regions.



4

ABOUT THE COMPANIES

A

Acurex Corp., 485 Clyde Ave., Mountain View 94042. Phone (415)964-3200. Employees 1977: 817; 1978: 900; Percent Increase: 10

ADAC Laboratories, 255 San Geronimo Way, Sunnyvale 94086. Phone (408)736-1101. Employees 1977: 75; 1978: 150; Percent Increase: 100

Addington Laboratories, 783 Palomar Ave., Sunnyvale 94086. Phone (408)738-4940. Employees 1977: 250; 1978: 265. Percent Increase: 6

Advanced Micro Devices, 901 Thompson Place, Sunnyvale 94086. Phone (408)732-2400. Employees 1977: 1900; 1978: 2600; Percent Increase: 37

Amdahl Corp., 1250 East Arques Ave., Sunnyvale 94086. Phone (408)746-6000. Employees 1977: 1647; 1978: 2500; Percent Increase: 52

American Microsystems Inc., 3800 Homestead Road, Santa Clara 95051. Phone (408)246-0330. Employees 1977: 1468; 1978: 1685; Percent Increase: 15

Anderson Jacobson Inc., 521 Chaucer Ave., San Jose 95131. Phone (408)263-8520. Employees 1977: 325; 1978: 400; Percent Increase: 33

Antekna Inc., 625 Clyde Ave., Mountain View 94043. Phone (415)965-0600. Employees 1977: 100; 1978: 200; Percent Increase: 100

Applied Materials Inc., 3050 Bowers Ave.,

Santa Clara 95051. Phone (408)249-5555. Employees 1977: 300; 1978: 350; Percent Increase: 17

Atari Inc., 1265 Borregas Ave., Sunnyvale 94086. Phone (408)745-2000. Employees 1977: 2000; 1978: 2000; No Increase

Avantek Inc., 3175 Bowers Ave., Santa Clara 95051. Phone (408)249-0700. Employees 1977: 563; 1978: 701; Percent Increase: 25

Aydin Systems, Inc., 644 Clyde Court, Mountain View 94043. Phone (415)968-7680. Employees 1977: 100; 1978: 100. No Increase.

B

BNR, Inc., 3174 Porter Dr., Palo Alto 94304. Phone (415)494-3942. Employees 1977: 125; 1978: 250; Percent Increase: 100

Basic Timesharing, 870 West Maude Ave., Sunnyvale 94086. Phone (408)733-1122. Employees 1977: 170; 1978: 300; Percent Increase: 76

Blomation Corp., 4600 Old Ironsides Dr., Santa Clara 95050. Phone (408)988-6800. Employees 1977: 178; 1978: 238; Percent Increase: 34

Boole and Babbage Inc., 510 Oakmead Parkway, Sunnyvale 94086. Phone (408)735-9550. Employees 1977: 97; 1978: 140; Percent Increase: 44

Boscher Associates, 384 Santa Trinita Ave., Sunnyvale 94086. Phone (408)732-2440. Employees 1977: 150; 1978: 340; Percent Increase: 127

C

California Microwave, Inc., 990 Almanor Ave., Sunnyvale 94086. Phone (408)732-4000. Employees 1977: 693; 1978: 661; Percent Decrease: 5

Calma Company, 527 Lakeside Dr., Sunnyvale 94086. Phone (408) 245-7522. Employees 1977: 175; 1978: 350. Percent Increase: 100

Coherent Inc., 3210 Porter Dr., Palo Alto 94304. Phone (415) 493-2111. Employees 1977: 275; 1978: 550; Percent Increase: 100

D

Data Point Peripheral Products, 686 West Maude Ave., Sunnyvale 94086. Phone (408)732-7330. Employees 1977: 375; 1978: 450; Percent Increase: 20

Data Pathing Inc., 370 San Aleso Ave., Sunnyvale 94086. Phone (408)734-0100. Employees 1977: 570; 1978: 640; Percent Increase: 12

Dictaphone Corp., 475 Ellis St., Mountain View 94043. Phone (415)968-8389. Employees 1977: 293; 1978: 296; Percent Increase: 1

crease: 1

E

EMI Therapy, 570 Del Rey Ave., Sunnyvale 94086. Phone (408) 245-3136. Employees 1977: 175; 1978: 135; Percent Decrease: 23

Echo Science, 485 East Middlefield Road, Mountain View 94040. Phone (415)961-7145. Employees 1977: 118; 1978: 117.

Exar Integrated Circuits, 750 Palomar Ave., Sunnyvale 94086. Phone (408)732-7970. Employees 1977: 85; 1978: 150; Percent Increase: 76

F

FMC Central Engineering, 1185 Coleman Ave., Santa Clara 95052. Phone (408)289-0111. Employees 1977: 226; 1978: 216; Percent Decrease: 4

Fairchild Corp., 464 Ellis St., Mountain View 94042. Phone (415)962-5011. Employees 1977: 19,000 (world wide figure). 1978 count not available.

Finnigan Corp., 845 West Maude Ave., Sunnyvale 94086. Phone (408)732-0940. Employees 1977: 350; 1978: 450; Percent Increase: 29

Ford Aerospace, 3939 Fabian Way, Palo Alto 94303. Phone (415) 494-7400. Employees 1977: 3950; 1978: 4136; Percent Increase: 5

Four Phase Systems, 10700 North DeAnza Blvd., Cupertino 95014. Phone (408)255-0900. Employees 1977: 1330; 1978: 1600; Percent Increase: 20

Fujitsu America, 2945 Oakmead Village Court, Santa Clara 95051. Phone (408)985-2300. Employees 1977: 78; 1978: 100; Percent Increase: 20

G

Granger Associates, 3101 Scott Blvd., Santa Clara 95051. Phone (408)985-7000. Employees 1977: 285; 1978: 400; Percent Increase: 40

GRT Corp., 1286 Lawrence Station Road, Sunnyvale 94086. Phone (408)734-2910. Employees 1977: 450; 1978: 325; Percent Decrease: 28

GTE Sylvania, P.O.B. 188, Mountain View 94042. Phone (415)966-9111. Employees 1977: 1700; 1978: 1800; Percent Increase: 6

H

Hewlett-Packard, 1501 Page Mill Road, Palo Alto 94304. Phone (415)856-1501. Employees 1977: 10,387; 1978: 12,176; Percent Increase: 17

I

Informatics, 1121 San Antonio Road, Palo Alto 94303. Phone (415)964-9900. Employees 1977:270; 1978:435. Percent Increase: 61.

Information Terminals Corp., 323 Soquel Way, Sunnyvale 94086. Phone (408)245-4400. Employees 1977: 800; 1978: 1000; Percent Increase: 25

Intel Corp., 3065 Bowers Ave., Santa Clara, 95051. Phone (408)987-8080. Employees 1977: 4,886; 1978: 7,150; Percent Increase: 46

Interall, Inc., 10710 North Tantau Avenue, Cupertino 95014. Phone (408)996-5000. Employees 1977:1379; 1978:1805 Percent Increase 31

K

Kaiser Electronics, 1651 Page Mill Road, Palo Alto 94036. Phone (415)493-3320. Employees 1977:650; 1978:1050. Percent Increase: 62.

Kasper Instruments, P.O. B. 9049, Sunnyvale 94086. Phone (408) 733-9800. Employees 1977:150; 1978:300; Percent increase:100

Keltron, 1380 Bordeaux Drive, Sunnyvale 94086. Phone (408) 734-0070. Employees 1977:155; 1978:215; Percent Increase:39

L

LFE Corp., 2920 San Ysidro Way, Santa Clara 95051. Phone (408) 732-9400. Employees 1977:135; 1978:100; Percent Decrease:26

Larce Corp., 4600 Patrick Henry Drive, Santa Clara 95050. Phone (408) 988-6600. Employees 1977:105; 1978:105. No change
Litronics, 19000 Homestead Road, Cupertino 95014. Phone (408) 257-7910. Employees 1977:232; 1978:360; Percent Increase:55

Lockheed Martin and Spacecraft Co., Inc., P.O. B. 504, Sunnyvale 94086. Phone (408)742-4321. Employees 1977:16,500; 1978:16,500. No increase.

Logical Machines Corp., 1294 Hammerwood Avenue, Sunnyvale 94086. Phone (408) 744-1290. Employees 1977:100; 1978:90; Percent Decrease:10

Logitron, 350 Potrero Ave., Sunnyvale 94086. Phone (408) 732-0441. Employees 1977:48; 1978:120. Percent Increase:150.

M

Maxman Integrated Circuits, 1220 Midas Way, Sunnyvale 94086. Phone (408)739-0560. Employees 1977:75; 1978:127; Percent Increase:169

Measures Corp., One Results Way, Cupertino 95014. Phone (408) 255-1500. Employees 1977:544; 1978:650; Percent Increase:19

Memorex Corp., San Tomas at Central Expy, Santa Clara 95052. Phone (408) 987-1000. Employees 1977:4333; 1978:5656; Percent

Increase: 25

Micro Mask Inc., 695 Vaqueros Ave., Sunnyvale 94086. Phone (408)245-7342. Employees 1977:100; 1978:115. Percent Increase: 15

Microform Data Systems, 830 Maude Avenue, Mountain View 94040. Phone (415)964-4635. Employees 1977:644; 1978:667; Percent Increase:4

Micro Power Systems, 3100 Alfred Street, Santa Clara 95050. Phone (408)247-5350. Employees 1977:178; 1978:230; Percent Increase:29

Monolithic Memories, 1165 Elati Arques Avenue, Sunnyvale 94086. Phone (408)739-3535. Employees 1977:400; 1978:300; Percent Increase:100

Mounata, 3400 Hillview Avenue, Palo Alto 94303. Phone (415) 493-3300. Employees 1977:208; 1978:240; Percent Increase:15

Moore Systems Inc., 1730 Technology Drive, San Jose 95110. Phone (408)297-9920. Employees 1977:171; 1978:189; Percent Increase:11

N

NBK Corp., 2371 Owen Street, Santa Clara 95051. Phone (408) 988-2600. Employees 1977:120; 1978:170; Percent Increase:42

National Semiconductor Corp., 2900 Semiconductor Drive, Santa Clara 95051. Phone (408) 737-5000. Employees 1977:6500; 1978:7400; Percent Increase:14

Northern Telecom, 2305 Mission College Blvd., Santa Clara 95050. Phone (415)961-9340. Employees 1977:400; 1978:650. Percent Increase: 63

O

Office Communications Inc., 766 Palomar Avenue, Sunnyvale 94086. Phone (408)739-2373. Employees 1977:20; 1978:165; Percent Increase:725

Omron Electronics - Information Products Division, 432 Toyama Drive, Sunnyvale 94086. Phone (408)734-8400. Employees 1977:100; 1978:120. Percent Increase: 20

Orrex Corp., 3303 Scott Blvd, Santa Clara 95050. Phone (408) 988-2000. Employees 1977:95; 1978:111; Percent Increase:17

Oulmetrix Inc., 1212 Terra Bella Avenue, Mountain View 94043. Phone (415)961-4380. Employees 1977:105 1978:275; Percent Increase:167

P

Pacific Reliability Corp., 765 North Mary Ave, Sunnyvale 94086. Phone (408)735-1380. Employees 1977:95; 1978:165; Percent Increase:74

Parkin-Elmer Utah, 2690 Casey Avenue, Mountain View 94040. Phone (415)967-2100. Employees 1977:163; 1978:210; Percent Increase:29

Precision Monolithics, 1500 Space Park Drive, Santa Clara 95050. Phone (408)246-9222. Employees 1977:346; 1978:480. Percent Increase: 39

Q

Quantor Corp., 520 Logue Ave., Mountain View, 94043. Phone (415)965-3700. Employees 1977: 360; 1978: 360; No Increase

R

Ramtek Corp., 385 North Mary Ave., Sunnyvale, 94086. Phone (408)735-8400. Employees 1977: 200; 1978: 225; Percent Increase: 25

Raytheon Company, 350 Ellis Street, Mountain View, 94042. Phone (415)968-9211. Percent Increase from 1977 to 1978: 30

Remote Computing Company, 1076 East Meadow Circle, Palo Alto, 94303. Phone (415) 494-6111. Employees 1977: 117; 1978: 79; Percent Decrease: 32

Reim Corporation, 4900 Old Ironsides Drive, Santa Clara, 95050. Phone (408)988-2900. Employees 1977: 600; 1978: 1200; Percent Increase: 100

S

Shugart Associates, 415 Oakmead Parkway, Sunnyvale, 94086. Phone (408)733-0100. Employees 1977: 700; 1978: 1200; Percent Increase: 71

Signetics, 811 E. Arques, Sunnyvale, 94086. Phone (408)739-7700. Employees 1977: 3080; 1978: 3924; Percent Increase: 28

Siliconix, 2201 Laurelwood Road, Santa Clara, 95054. Phone (408)988-8000. Employees 1977: 900; 1978: 1018; Percent Increase: 13

Singer/Link Division, 1077 E. Arques Ave., Sunnyvale, 94086. Phone (408)732-3800. Employees 1977: 420; 1978: 840; Percent Increase: 100

Selfan Systems, Inc., 663 Clyde Ave., Mountain View, 94043. Phone (415)964-7020. Employees 1977: 100; 1978: 150; Percent Increase: 50

Spectra Physics, 1250 West Middlefield Road, Mountain View, 94042. Phone (415)961-2550. Employees 1977: 1012; 1978: 1420; Percent Increase: 40

Stanford Telecommunications, Inc., 1193 Bordeaux Drive, Sunnyvale, 94086. Phone (408)734-5300. Employees 1977: 68; 1978: 118; Percent Increase: 74

Symtek, 3001 Stender Way, Santa Clara, 95051. Phone (408)988-5600. Employees 1977: 450; 1978: 825; Percent Increase: 83

Systems Control, Inc. 1801 Page Mill Road, Palo Alto, 94304. Phone (415)494-1165. Employees 1977: 240; 1978: 280; Percent Increase: 17

T

Tandem Computers, Inc., 19333 Valico Parkway, Cupertino, 95014. Phone (408)996-6000. Employees 1977: 110; 1978: 190; Percent Increase: 73

Technicon Medical Information Systems Corp., 3255-I Scott Blvd., Santa Clara, 95051. Phone (408) 249-9400. Employees 1977: 136; 1978: 180; Percent Increase: 15

Technology Development Co., 155 Moffett Park Drive, Building C, Sunnyvale, 94086. Phone (408)734-5300. Employees 1977: 95; 1978: 185; Percent Increase: 95

Technology for Communications International, 1625 Stierlin Road, Mountain View, 94043. Phone (415)961-9180. Employees 1977: 80; 1978: 100; Percent Increase: 25

Telco Supply, Inc., 350 Bernardo Ave., Mountain View, 94043. Phone (415)969-4200. Employees 1977: 70; 1978: 80; Percent Increase: 14

Telesensory Systems, Inc., 3408 Hillview Ave., Palo Alto 94304. Phone (415)493-2626. Employees 1977: 125; 1978: 225. Percent Increase: 80

Tri Data, 505 E. Middlefield Road, Mountain View 94043. Phone (415)969-3700. Employees 1977: 115; 1978: 115. No Increase.

Tymshare, Inc., 20705 Valley Green Drive, Cupertino, 95014. Phone (408)446-6000. Employees 1977: 504; 1978: 582; Percent Increase: 15

V

Varian Associates, 611 Hansen Way, Palo Alto, 94303. Phone (415)493-4000. Employees 1977: 5000; 1978: 5000; No Increase

W

Watkins-Johnson, 3333 Hillview Ave., Palo Alto, 94304. Phone (415)493-4141. Employees 1977: 2400; 1978: 3000; Percent Increase: 25

X

Xerox Co., 3333 Coyote Hill Road, Palo Alto 94304. Phone (415) 494-4000. Employees 1977: 250; 1978: 261. Percent Increase: 5

Z

Zantec Corp., 2400 Walsh Ave., Santa Clara 95050. Phone (408) 246-7662. Employees Percent Increase from 1977 to 1978: 35

Zilog, Inc., 10460 Bubb Road, Cupertino, 95014. Phone (408)446-4666. Employees 1977: 175; 1978: 548; Percent Increase: 225

These are the top 14 companies in the South Bay Area ranked by percentage increase in the number of employees from 1977 to 1978, according to available information:

	Percent
1. Office Communications, Inc	725
2. Zilog, Inc.	225
3. Tandem Computers	173
4. Maruman Integrated Circuits	169
5. Oximetrix	162
6. Logisticon	150
7. Boschert Associates ...	127
8. Kasper Instruments ...	100
9. BNR, Inc.	100
10. ADAC Laboratories ...	100
11. Monolithic Memories ..	100
12. Rolm Corporation	100
13. Antekna, Inc.	100
14. Singer/Link Division ..	100

These are the top ten companies in the South Bay Area ranked in terms of the net increase in the number of employees from 1977 to 1978:

	Increase
1. Intel Corp.	2264
2. Hewlett-Packard	1707
3. Memorex	1117
4. National Semiconductor	900
5. Amdahl Corp.	853
6. Rolm Corp.	600
7. Watkins-Johnson	600
8. Shugart Associates	500
9. Singer/Link Division ..	420
10. Spectra Physics	408

Attitude Research, Inc. was commissioned by SAN JOSE Magazine to conduct the research and evaluate the data which forms these listings.

NOTE: Telephone numbers listed herein are, generally, the respective firms' main incoming trunk number. Employment inquiries should be directed to individual personnel departments.



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0100 ACOUSTICS SPEECH & SIGNAL PROCESSING

- 0110 Digital Measurement of Noise
- 0120 Digital Signal Processing
- 0130 Audio and Electroacoustics
- 0140 Speech Processing
- 0150 Underwater Acoustics

0200 BROADCASTING/CABLE/CONSUMER ELECTRONICS

- 0220 Broadcasting
- 0221 TV Transmitters and Antennas
- 0222 AM/FM Transmitters & Antennas
- 0223 Video Signal Transmission
- 0224 Video Switching & Distribution
- 0225 Broadcast Audio
- 0226 Broadcast TV Live Cameras
- 0227 Broadcast Telecine
- 0228 Video Signal Processing Theory/Technology
- 0229 Theatrical Film Production by TV
- 0230 Pay TV Technology
- 0240 General BCCE Technology
- 0241 Audio, Video & R.F. Measurements
- 0242 Remote & Automatic Control
- 0243 Video Tape Recording
- 0244 Technical Operations
- 0245 Product Safety Performance
- 0246 Materials, Parts & Components
- 0247 Spectrum Utilization
- 0248 Colorimetry
- 0249 Graphic Generation, Storage & Display
- 0250 Test Equipment
- 0251 Digital Video Gen./Storage/Display
- 0260 Cable Systems
- 0261 RF Distribution Systems
- 0262 Coaxial Cable & Fibre Optics
- 0263 Heterodyne Proc./Modulators/Demod.
- 0264 Data Transmissions & Terminals
- 0265 Pay Cable Technology
- 0266 Closed Cir. TV Camera/Telecine Equip.
- 0267 Antennas, Preamplifiers & Converters
- 0268 Security Systems
- 0280 Consumer Electronics
- 0281 Home TV Receivers
- 0282 Industrial TV Receivers & Displays
- 0283 Home AM & FM Sound Receivers
- 0284 Home Recorder/Playback Media
- 0285 Games
- 0286 Calculators
- 0287 TV Standards Conversion
- 0288 Microprocessor Applications & Control

0300 ANTENNAS & PROPAGATION

- 0310 Antennas
- 0311 Reflectors & Lens Antennas
- 0312 Arrays
- 0313 Wire & Other Antenna
- 0314 MM & Sub MM Techniques
- 0320 Propagation
- 0321 Earth & Sea
- 0322 Troposphere
- 0323 Ionosphere
- 0324 Magnetosphere
- 0330 Electromagnetic Theory
- 0331 Scattering & Diffraction
- 0332 Non-uniform, Time Varying Media
- 0333 Numerical Methods
- 0334 Synthesis
- 0340 Electromagnetic Interaction Effects
- 0341 Materials
- 0342 Plasmas
- 0343 Biological
- 0350 Systems Applications
- 0351 Radio Astronomy
- 0352 Radar
- 0353 Communication
- 0354 Radiometers
- 0355 Integrated Optics

0400 CIRCUITS & SYSTEMS

- 0410 Circuit Signal & System Theory
- 0420 Circuit & System Design
- 0430 Solid State & Microwave Circuits
- 0440 Digital & Switching Circuits
- 0450 Filters

- 0460 Networks Analysis & Synthesis
- 0470 Computer Aided Network & System Design
- 0480 Modeling, Approximation & Optimization
- 0490 Networks & Graph Theory
- 0495 Large-Scale Systems & Networks

0500 NUCLEAR & PLASMA SCIENCES

- 0510 Nuclear Science
- 0511 Particle Accelerator Science & Technology
- 0512 Reactor Instrumentation & Controls
- 0513 Radiation Effects
- 0514 Nuclear Instruments & Detectors
- 0515 Environmental Measurements & Monitoring
- 0516 Nuclear Medical Science
- 0520 Plasma Sciences
- 0521 Plasma Science & Applications
- 0522 Fusion Technology
- 0523 Magnetohydrodynamics

0600 VEHICULAR TECHNOLOGY

- 0610 Vehicular Communications
- 0620 Portable Communications
- 0630 Personal Communications
- 0640 Marine Communications
- 0650 Air motive Electronics
- 0660 Electric Cars
- 0670 Highway Electronics
- 0680 Command & Control
- 0690 Automotive Electrical Technology

0700 RELIABILITY

- 0710 Maintainability
- 0720 Reliability Physics
- 0730 Human Effects
- 0740 Software
- 0750 Applications
- 0751 Manufacturing
- 0752 Oceanography

0800 INSTRUMENTATION & MEASUREMENTS

- 0810 Fundamental Electrical Standards
- 0820 HF Instrumentation & Measurement
- 0830 LF Instrumentation & Measurement
- 0840 Materials Measurements
- 0850 Electromagnetic Measurements
- 0860 Frequency & Time

1000 AEROSPACE & ELECTRONIC SYSTEMS

- 1010 Technology & Systems Development
- 1011 Flight Vehicle Power Systems
- 1012 Energy Conversion & Conditioning
- 1013 Gyroscopes & Accelerometers
- 1014 Instrumentation in Aerospace Simulation
- 1015 Radar Systems
- 1016 Airborne Instrumentation
- 1017 Support Systems (incl. Ground Equip.)
- 1018 Electronic Aids to Navigation
- 1019 Sonar Systems
- 1020 Systems Application and Analysis
- 1021 Satellite Systems
- 1022 Air Defense Systems
- 1023 Civil Systems
- 1024 Ocean Systems
- 1025 Navigation, Guidance & Control Sys.
- 1026 Systems Effectiveness
- 1027 Systems Engineering

1200 INFORMATION THEORY

- 1210 Algebraic Coding
- 1220 Shannon Theory, Probabilistic Coding
- 1230 Communications
- 1240 Detection, Estimation & Identification
- 1250 Stochastic Processes
- 1260 Pattern Recog., Learning, Hypothesis Test.

1300 INDUSTRIAL ELECTRONICS & CONTROL INSTRUMENTATION

- 1310 Sensors, Transducers, & Prime Movers
- 1320 Power Electronics (Thyristors, SCRs, Inv. & Conv.)
- 1330 Data Acquisition, Signal Processing & Distr. Systems

1340 Theory & Application of Instrumentation & Control

- 1350 Computer Control, Software, Hardware & Architecture
- 1360 Energy Management & Control
- 1370 Industrial Applications of Microprocessors
- 1380 Industr. Consumer & Automotive Prod. Contr. Appl.
- 1390 Automated Manufact., Numerical Contr. & Robotics

1400 ENGINEERING MANAGEMENT

- 1410 Management Development & Training
- 1420 Management Policies, Methods, Procedures
- 1430 Systems Management
- 1440 Program, Project Management
- 1450 Technical Information
- 1451 Technology Transfer
- 1452 Technology Forecast
- 1454 Technology/Society Interaction
- 1460 Professional Develop. & Motivation
- 1470 Resource Management
- 1471 Projection Selection
- 1480 Organization

1500 ELECTRON DEVICES

- 1510 Electron Tubes & Electron Beam Devices
- 1520 Semiconductor Discrete Devices
- 1530 Integrated Electronics
- 1540 Optoelectronic Devices
- 1550 Energy Conversion Devices
- 1560 Quantum Electronics
- 1570 Superconductive Devices
- 1580 Power Electronics
- 1590 Display Devices

1600 COMPUTERS

- 1610 Software
- 1611 Operating Systems
- 1612 Software Engineering
- 1620 Hardware
- 1621 Digital Circuits
- 1622 Memory
- 1623 Peripherals
- 1624 Terminals & Displays
- 1630 Theory
- 1640 Simulation
- 1650 Applications
- 1660 Systems
- 1661 Computer Architecture
- 1662 Computer Networks
- 1663 Microprogramming
- 1664 Mini/Micro Computers
- 1665 Storage Subsystems
- 1666 Telecommunications
- 1670 Manufacturing
- 1680 Management
- 1681 Education
- 1690 Information Processing
- 1691 Data Bases
- 1692 Data Management
- 1693 Image Processing
- 1694 Pattern Recognition

1700 MICROWAVE THEORY & TECHNIQUES

- 1710 Microwave Semiconductor Devices
- 1720 Microwave Electr. Tubes & Plasma Devices
- 1730 Microwave Magnetics
- 1740 Microwave Acoustics
- 1750 Passive Components (Waveguides, etc.)
- 1760 Microwave Circuits & Subsystems
- 1780 Millimeter & Submillimeter Waves
- 1790 Applications of Microwaves
- 1791 Biological Effects

1800 ENGINEERING IN MEDICINE & BIOLOGY

- 1810 Biomedical Signal Processing
- 1815 Image Processing
- 1820 Computers in Medicine
- 1825 Data Acquisition Systems
- 1830 Physiological Systems Modeling

1840 Prosthetic & Sensory Aids
1850 Biomedical Instrumentation
1855 Ultrasound in Medicine
1860 Bioelectric Phenomena
1870 Transducer Devices
1880 Biomedical Materials
1890 Clinical Engineering

1900 COMMUNICATIONS

1910 Communication Switching
1915 Telecommunications Traffic
1920 Radio Communication
1930 Space Communication
1940 Wire Communication
1950 Data Communication System
1955 Telemetry
1960 Communication Electronics
1970 Communication Systems Disciplines
1980 Communication Theory
1990 Computer Communications

2000 SONICS & ULTRASONICS

2010 Sonic-wave Propgn in Solid, Liquid, Gas
2015 Underwater Sound
2020 Piezoelectricity
2030 Magnetostriction
2040 Analog Signal Processing in RF & MW Range
2050 Digital Processing and Storage
2060 Acousto-Optical Devices & Techniques
2070 Ultrasonic Imaging & Visualization
2080 Ultrasonic Processing & Therapy
2090 Ultrasonic Nondestructive Eval. of Mat'l.

2100 COMPONENTS, HYBRIDS & MANUFACT. TECHNOL.

2110 Electrical Contacts & Connectors
2120 Connections & Interconnections
2121 Printed Wiring
2130 Materials & Processes
2140 Hybrid Microelectronics
2150 Manufacturing Technology
2151 Contamination Control
2152 Assembly Technique
2153 Test Technique
2154 Automation
2155 Quality Control Techniques
2156 Specifications and Standards
2157 Management Practices
2158 Productivity
2159 Computer Applications
2160 Electronic Packaging
2170 Educational Activities
2180 Discrete Component Parts & Subassemblies
2190 Specifications & Documentation

2200 OCEANIC ENGINEERING

2210 Components & Systems
2230 Testing & Reliability
2240 Instrumentation & Monitoring
2250 Transducers
2260 Modeling
2290 Standards

2300 CONTROL SYSTEMS

2310 Adaptive & Learning Systems
2320 System Evaluation, Applications
2330 Computational Methods
2340 Estimation Identification
2350 Large Systems
2360 Linear Systems
2370 Optimal Systems
2380 Stability Nonlinear Systems
2390 Applications
2391 Transportation Systems
2392 Urban & Social Systems
2393 Utility Systems
2394 Economic Systems

2500 EDUCATION

2510 Educational Methods
2520 Educational Technology
2530 Instructional Materials
2540 Educational & Professional Develop.
2550 History

2600 PROFESSIONAL COMMUNICATION

2610 General Writing & Editing Techniques
2620 General Illustration Techniques
2630 Technical Publications
2640 Management
2640 Technical Presentations
2650 Reproduction Techniques
2660 Information Processing
2670 Non-print Media
2680 Technical Journalism
2690 Technical Writing Education

2700 ELECTROMAGNETIC COMPATIBILITY

2710 Methods of Measurement & Mes. Equip.
2720 Origin of Interference-Lightning, Static
2730 Equip. EMC Assurance & Prediction
2740 Systems EMC Assurance & Prediction
2750 Spectrum Util. & Advanced EMC Effects
2760 Tempest & Emp. Subjects
2770 Radiation Hazards, Fuses, Personnel, etc.
2780 Walsh Functions & EMC Applications

2800 SYSTEMS, MAN & CYBERNETICS

2810 Systems Science
2811 Modeling & Simulation
2812 Systems Analysis & Decision Analysis
2813 Technological Forecasting & Assessment
2814 Societal Policy Research
2815 Econ, Environ, Social, & Urban Systems
2820 Cybernetics
2821 Adaptive Systems
2822 Pattern Recognition
2823 Bio-cybernetics
2830 Man-machine Systems
2831 Human & Social Values

2900 GEOSCIENCE ELECTRONICS

2910 Solid Earth
2920 Oceanic
2930 Atmospheric
2940 Space
2950 Pollution
2960 Earth Resources
2970 Exploration
2980 Interaction Effects-Air-Sea-Space-Earth
2990 Data Acquisition, Transmission & Process

3100 POWER ENGINEERING

3110 Insulated Conductors
3120 Power Generation
3130 Power System Engineering
3132 Power System Communications
3134 Power Systems Instrumentation & Meas.
3136 Power Systems Relaying
3140 Rotating Machinery
3150 Substations
3160 Surge Protective Devices
3170 Switchgear
3180 Transformers
3190 Transmission & Distribution

3200 ELECTRICAL INSULATION

3210 Dielectric Phenomena
3211 Corona
3212 Tracking
3220 Dielectric Materials
3221 Encapsulants
3222 Liquid Dielectrics
3223 Magnet Wire
3224 Materials for Electronics
3225 Materials for Space Dielectrics

3300 MAGNETICS

3310 Control & Power Conversion
3315 Large Magnet Technology
3320 Electronic Transformers
3325 Magnetic Separation
3330 Environment Effects & Reliability
3335 Memories and Magnetic Bubbles
3340 Magnetic Recording
3345 Magnetics in Life Sciences

3350 Measuring Technology
3355 Soft Magnetic Materials
3360 Microwave Magnetics
3380 Superconducting Magnets & Materials
3390 Permanent Magnets

3400 INDUSTRIAL APPLICATIONS

3410 Corrosion & Cathodic Protection
3411 Electrostatic Processes
3412 Power Semiconductor
3413 Static Power Converter
3420 Industrial & Commercial Power Systems
3421 Industrial Control
3430 Application, Mobile
3431 Land Transportation
3432 Marine Transportation
3440 Application, Light
3441 Domestic Appliance
3442 Elect. Space Heating & Air Conditioning
3443 Production & Application of Light
3444 Textile Industry
3450 Application, Heavy
3451 Cement Industry
3452 General Application
3453 Glass Industry
3454 Metal Industry
3455 Mining Industry
3456 Petroleum & Chemical Industry
3457 Pulp & Paper Industry
3458 Rubber & Plastic Industry
3460 Electric Process Heating
3470 Machine Tool Industry
3480 Rural Electric
3490 Electrical Safety, Industry & General

3600 QUANTUM ELECTRONICS

3610 Lasers
3620 Electro-Optics
3630 Acousto-Optics
3640 Harmonic Generation & Upconversion
3650 Quantum Detectors
3660 Integrated Optics
3670 Fibre Optics

3700 SOLID STATE CIRCUITS

3710 Integrated Electronics
3720 Memristor-Semicond, Magnetic & Elect-Opt
3730 Optoelectronics
3740 Comp. Aids to Design-Anal, Msk, Layout, Test
3750 Solid State Microwave Electronics
3760 New Device Applications
3770 Solid State Circuit Design Techniques
3780 Medical Electronics

3800 INTERDISCIPLINARY & NEW ACTIVITIES

3810 Technology/Society Interactions
3811 Social Responsibility & Ethics
3812 Energy
3813 Electrotechnology & National Security
3814 Education & Communication
3815 Data Banks & Electronic Surveillance
3816 Government Role in Science & Engineering
3817 Other Applications of Electrotechnology
3818 Communications Policies
3820 Transportation
3830 Electrophysics
3840 Environmental Quality
3841 Nonionizing Radiation
3842 Ionizing Radiation
3850 Optical & Electro-optical Systems
3860 History of Engineering
3861 Awards and Recognition
3862 Transnational Relations
3870 Cryogenics & Superconductivity
3880 Technology Forecasting & Assessment
3890 Socio-Economic Employment Issues

1	2	3	4	5	6	7	8	9	10

TIP
11/79

APPLICATION FOR EMPLOYMENT

PERSONAL INFORMATION

Date			Social Security Number		
Name		Age	Sex		
Last	First	Middle			
Present Address					
Street		City	State	Zip	
Permanent Address					
Street		City	State	Zip	
Phone Number		Own Home	Rent	Board	
Date of Birth	Height	Weight	Color of Hair	Color of Eyes	
Married	Single	Widowed	Divorced	Separated	
Number of Children		Dependents Other Than Wife or Children		Citizen of U. S. A.	Yes ☐ No ☐
If Related to Anyone in Our Employ, State Name and Department			Referred By		

EMPLOYMENT DESIRED

Position	Date You Can Start	Salary Desired
Are You Employed Now?		If So May We Inquire of Your Present Employer
Ever Applied to this Company Before?		Where When

EDUCATION	Name and Location of School	Years Attended	Date Graduated	Subjects Studied
Grammar School				
High School				
College				
Trade, Business or Correspondence School				

Subjects of Special Study or Research Work

What Foreign Languages Do You Speak Fluently?

Read

Write

U. S. Military or Naval Service

Rank

Present Membership in National Guard or Reserves

Activities Other Than Religious (Civic, Athletic, Fraternal, etc.)

EXCLUDE ORGANIZATIONS THE NAME OR CHARACTER OF WHICH INDICATES THE RACE, CREED, COLOR OR NATIONAL ORIGIN OF ITS MEMBERS.

(Continued on Other Side)

FORMER EMPLOYERS (List Below Last Four Employers, Starting With Last One First)

Date Month and Year	Name and Address of Employer	Salary	Position	Reason for Leaving
From				
To				
From				
To				
From				
To				
From				
To				

REFERENCES: Give Below the Names of Three Persons Not Related To You, Whom You Have Known At Least One Year.

Name	Address	Business	Years Acquainted
1			
2			
3			

PHYSICAL RECORD:

List Any Physical Defects

Were You Ever Injured?	Give Details
Have You Any Defects In Hearing?	In Vision? In Speech?
In Case of Emergency Notify	Name Address Phone No.

I authorize investigation of all statements contained in this application. I understand that misrepresentation or omission of facts called for is cause for dismissal. Further, I understand and agree that my employment is for no definite period and may, regardless of the date of payment of my wages and salary, be terminated at any time without any previous notice.

Date Signature

DO NOT WRITE BELOW THIS LINE

Interviewed By Date

REMARKS:

Neatness		Character	
Personality		Ability	

Hired	For Dept.	Position	W'd Report	Salary Wages
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Approved: 1.	2.	3.
Employment Manager	Dept. Head	General Manager